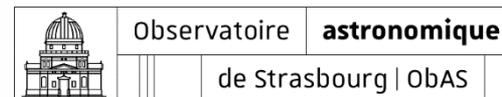


Simbad, VizieR & Aladin

The CDS astronomical tool suite

Astronomical Software Lecture at NADC
18 January 2021

Pierre Fernique



□ Who am I ?

I'm mostly a person who loves to develop software. Programming is a real pleasure, a challenge.

Discovering the Internet in its infancy in 1990, until using it day-after-day in the context of my work has been a chance for me.

Realized that in the astronomical context – at the Centre de Données astronomiques de Strasbourg - adds a lot to my personal story.

走进天文软件的“无冕之王”天文软件大师新年讲座系列
New Year Lectures from Astronomical Software Masters

SIMBAD, VIZIER AND ALADIN:
THE CDS ASTRONOMICAL TOOL SUITE

报告人: **Pierre Fernique**

简介:
Pierre Fernique is the Technical Director of the Strasbourg Astronomical Data Centre (CDS). He obtained his PhD in computer science in 1994 from the University of Strasbourg. He joined the Observatoire de Strasbourg in 1996. He was in charge of the CDS Aladin project from 2006 to 2019, chair of the IVOA Application Working Group from 2014 to 2018, first author of MOC (2014) and HiPS (2017) IVOA standards.

讲座时间: **2021年1月18日 16:00 (UTC 8:00)**
讲座平台: **ZOOM会议室**

主办: 国家天文台、中国天文学会信息化工作委员会
承办: 国家天文科学数据中心、国家天文台团委
协办: 国家高能物理科学数据中心、国家空间科学数据中心、广州大学天体物理中心

讲座详情请关注“虚拟天文台”微信公众号和国家天文科学数据中心网站



□ The CDS history

« Centre de Données astronomiques de Strasbourg »
created by The French Ministry of Education and Research in 1972



*“Collect "useful" data on astronomical objects, in electronic form;
Improve them by critically evaluating them and combining them;
Distribute the results to the international community...”*

CDS charter

early version of **FAIR**

Findable, Accessible, Interoperable, Reusable

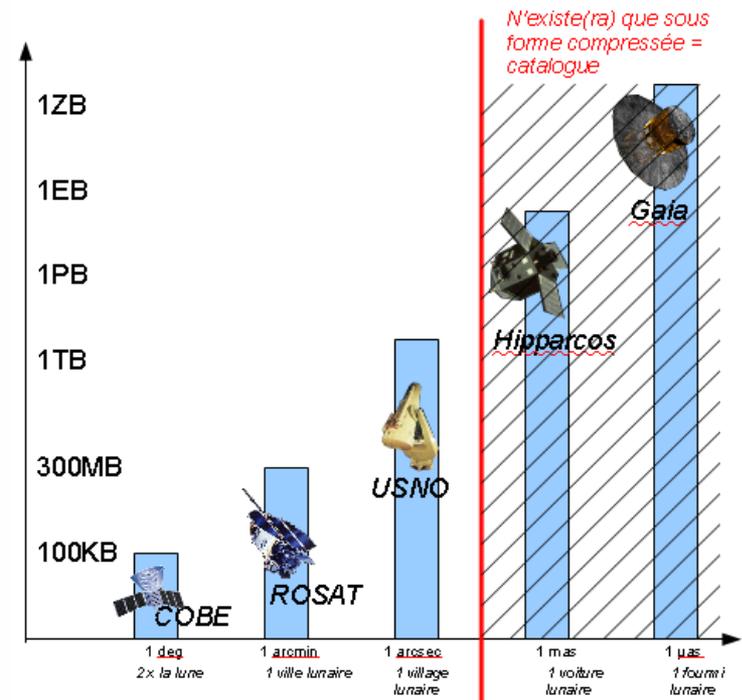
□ The base of astronomy

Observe the sky as accurately as possible

=> Always at the limit of the technology

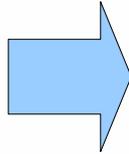
Ie.: Gaia mission a few μ -arcsecond of resolution (= 1 coin on the moon seen from the earth)

=> An image survey would require 1 ZETAoctets



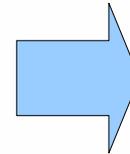
□ How to manipulate these observations

Images



catalogs

MAIN ID	OTHER	RA	DEC	OBJ	OBJ	C	PERA	PEREC
M101	F141410_054500	14 14 45.5	+54 49 00.0					
M101	F141410_054502	14 14 18.55	+54 25 21.9					
M101	F141410_054504	14 14 45.72	+54 44 25.6					
M101	F141410_054506	14 14 18.38	+54 23 14.9	6.74	5.71	10	14.13	-1.41
M101	F141410_054508	14 13 18.00	+54 23 36.0	18000	18000	171		
M101	F141410_054510	14 18 43.97	+54 24 50.3	23.26	20.24	0	-54.9	37.9
M101	F141410_054512	14 13 36.33	+54 20 14.0	3000	3000	90		
M101	F141410_054514	14 13 21.89	+54 40 06.0	3000	3000	40		
M101	F141410_054516	14 14 28.69	+54 16 54.0	3000	3000	171		
M101	F141410_054518	14 14 28.09	+54 36 36.0	37000	19500	9		
M101	F141410_054520	14 12 24.90	+54 42 40.0	30000	30000	157		
M101	F141410_054522	14 12 22.00	+54 42 42.0	65000	51700	0		
M101	F141410_054524	14 15 13.40	+54 40 22.6	3300	3300	90		
M101	F141410_054526	14 15 52.90	+54 55 16.0	20000	20000	120		
M101	F141410_054528	14 16 38.30	+54 07 19.9	300	300	10		
M101	F141410_054530	14 15 07.60	+54 48 05.4	300	300	21		
M101	F141410_054532	14 16 02.70	+54 53 16.3	300	300	146		
M101	F141410_054534	14 13 35.95	+54 26 40.6	6900	3200	90		
M101	F141410_054536	14 11 30.60	+54 32 39.6	43.56	39.54	0	-9.3	-14.9
M101	F141410_054538	14 13 36.00	+54 25 51.6	41.62	34.91	0	-6.2	1.8
M101	F141410_054540	14 14 27.64	+54 17 06.5	36.78	31.93	90	-7.6	-6.8
M101	F141410_054542	14 15 07.90	+54 54 17.6	39.6	38.93	90	-12	-7.1
M101	F141410_054544	14 16 36.70	+54 48 40.4	84.74	41.74	0	21.5	9.6
M101	F141410_054546	14 14 55.90	+54 17 36.6	94.8	39.62	90	-9.1	-7.5
M101	F141410_054548	14 15 02.97	+54 13 24.8	38.55	27.93	90	39.5	-33.2
M101	F141410_054550	14 15 46.40	+54 40 07.7	34.77	31.4	90	-20.7	-13.2
M101	F141410_054552	14 15 09.82	+54 29 45.2	44.1	37.69	0	15.4	-43.9
M101	F141410_054554	14 14 42.00	+54 22 00.0					
M101	F141410_054556	14 13 37.90	+54 24 14.0					
M101	F141410_054558	14 14 15.70	+54 25 23.0					
M101	F141410_054560	14 14 45.70	+54 46 53.5					
M101	F141410_054562	14 14 56.60	+54 56 54.5					
M101	F141410_054564	14 12 21.90	+54 32 36.0					
M101	F141410_054566	14 14 48.00	+54 53 46.0	300	300	147		
M101	F141410_054568	14 12 07.00	+54 29 50.0	300	300	94		
M101	F141410_054570	14 13 40.40	+54 26 37.0	300	300	5		
M101	F141410_054572	14 14 51.60	+54 28 17.0	300	300	18		



objects

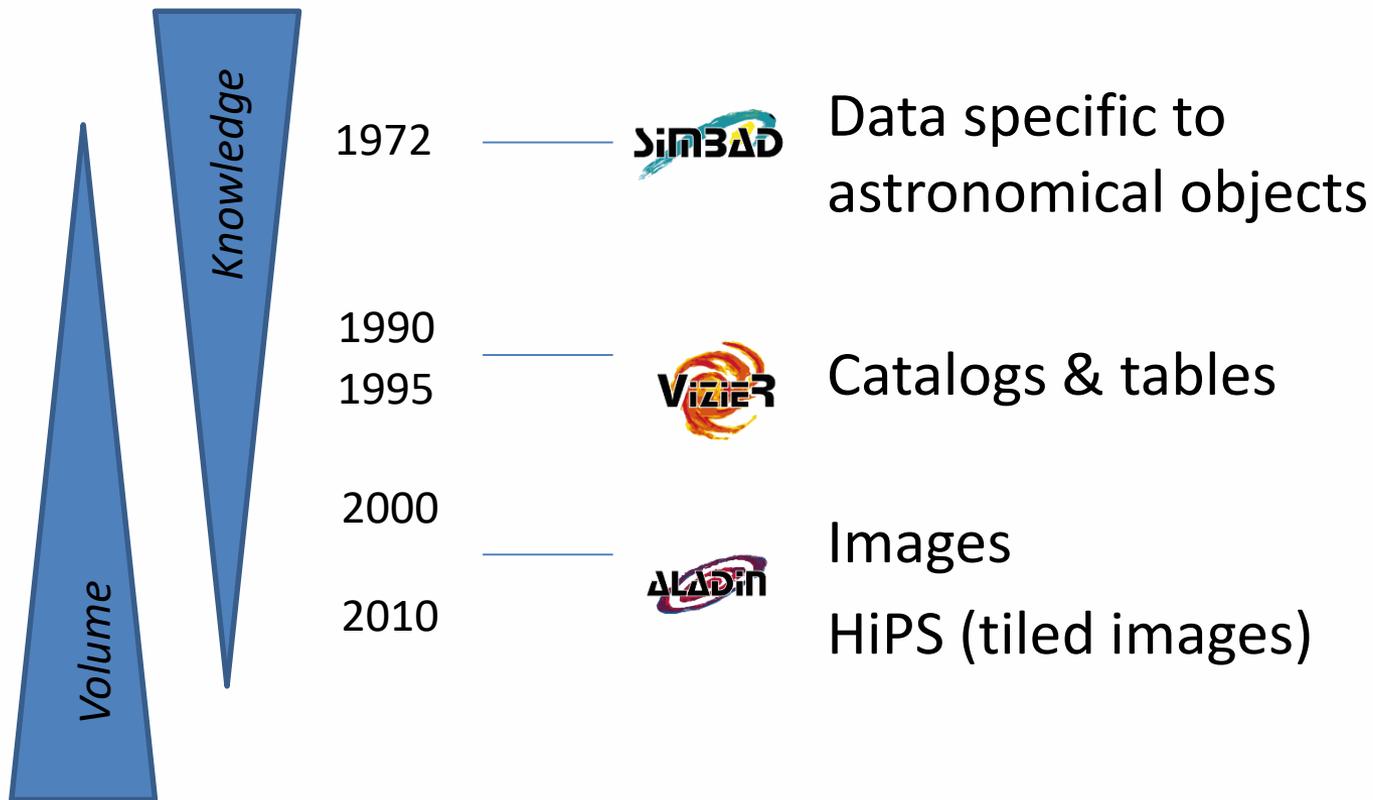
Observation data (J2000 epoch)	
Constellation	Ursa Major
Right ascension	14 ^h 03 ^m 12 ^s .6 ⁹
Declination	+54° 20' 57"
Redshift	0.000804
Helio radial velocity	241 ± 2 km/s
Distance	20.9 ± 1.8 Mly (6.4 ± 0.5 Mpc)
Apparent magnitude (V)	7.86
Characteristics	
Type	SAB(rs)cd
Number of stars	1 trillion (10 ¹²)
Size	~170,000 ly in diameter ^[1]
Apparent size (V)	28' 8 × 26' 9
Other designations	
Messier 101, M101, NGC 5457, UGC 8981, PGC 50063, Arp 26	
References: [2][3][4][5][6][7]	

Volume

Knowledge

□ Which data the CDS provided?

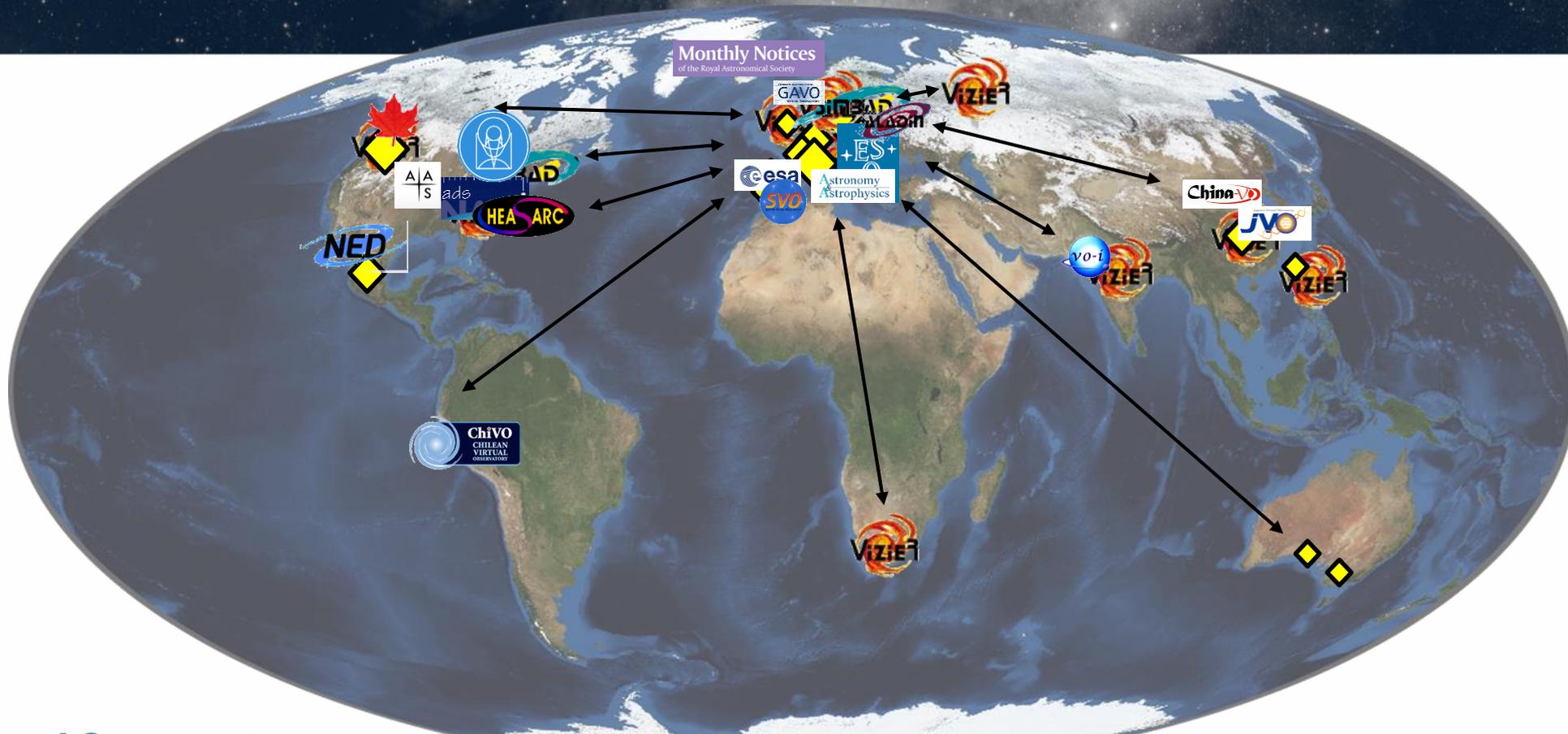
The data that we **technically** can !



□ CDS figures: 3-500-16-2^{E6}

- **3** services: Simbad, VizieR & Aladin
- **500** TB of data
- **16** operational sites/servers on 5 continents (7 local servers + 9 mirrors)
- Around **2 million** requests per day

□ The CDS implementation



16 servers/sites managed by CDS staff (local servers + mirrors)

+ **Dozens** of collaborative institutes/data centers/publishers... (especially 18 HiPS nodes) which abound their own service with CDS data, and **reciprocally**

+ **Thousands** of clients

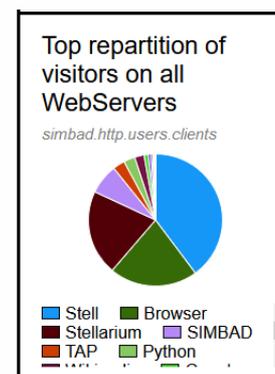
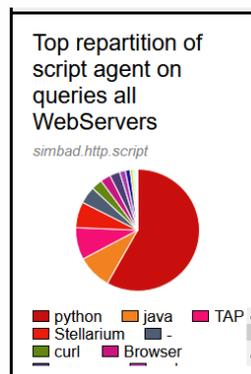
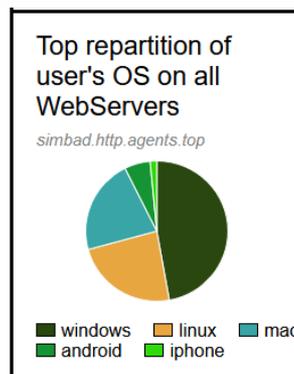
□ The CDS clients

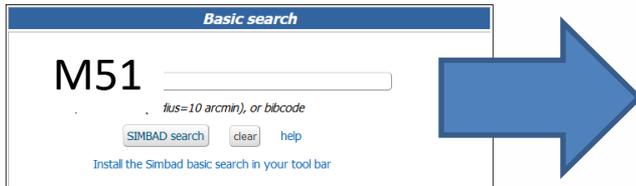
CDS products:

- CDS Web pages
- CDS toolkit
- CDS widgets
- Aladin Lite
- Aladin Desktop
- ...

Others:

- TAP & other IVOA libs
- Astropy & PyVO python libs
- TOPCAT
- ESASky
- Stellarium
- WWT
- Digistar
- ...





- The Simbad database contains information around 11,500,000 astronomical objects
- Daily updated by CDS documentarists & astronomers from astronomical literature & mission catalogs
- Java + Postgres DB
- 3 main developers (*M.Wenger, A.Oberto, G.Mantelet*)

Basic data

M 51 -- Galaxy in Pair of Galaxies

Other object types: rG (), Sy2 (), G (2014AJ,APG,...), Rad (B3,BWE,...), AGN ([VV2000c], [VV2003c],...), X (RX,1RXS,...), IR (IRAS,ISOSS,...), * (BD,FLX), G1P (KPG,[T76]), IG (VV), G1G ([CHM2007])

ICRS coord. (*ep=J2000*): 13 29 52.698 +47 11 42.93 (Infrared) [] C 2006AJ....131.1163S

FK4 coord. (*ep=B1950 eq=1950*): 13 27 46.321 +47 27 10.59 []

Gal coord. (*ep=J2000*): 104.851585 +68.560702 []

Radial velocity / Redshift / cz: V(km/s) 465 [61] / z(-) 0.00155 [0.00020] / cz 465.0 [61.0]
D 1999PASP...111..438F

Parallaxes (*mas*): 7.8 [16.9] E 1995GCTP...C.....0V

Morphological type: SA C 2019MNRAS.488..590B

Angular size (*arcmin*): 10.00 7.59 163 (Opt) D 2003A&A...412...45P

Fluxes (6): B (AB) 9.26 [0.03] C 2014MNRAS.445..881C
V 8.36 [0.06] D 2007ApJS...173..185G
R (AB) 8.40 [0.03] C 2014MNRAS.445..881C
J 6.401 [0.019] C 2006AJ....131.1163S
H 5.653 [0.020] C 2006AJ....131.1163S
K 5.496 [0.025] C 2006AJ....131.1163S

Hierarchy

parents : 2 children : 2369 siblings : 136 Display criteria : All

Identifiers

M 51	IRAS 13277+4727	143
APG 85A	ISOSS J13299+4714	TC 827
APG 85	KHG 1-C 5	UGC 8493
B3 1327+474C	KPG 379a	UZC J132952.1+471144
BD+47 2063	LEDA 47404	VV 403
...	...	VV 1a

Biblio. references

[2021AJ....161...29Z](#) [T A S X C ,32]

Astron. J., 161, 29-29 (2021/January-0)

A method to extract spatially resolved polycyclic aromatic hydrocarbon emission
ZHANG L., HO L.C. and XIE Y.

Simbad objects: 1

[2020A&A...633A..17B](#) [T K A X C D ,43]

Astronomy and Astrophysics, volume 633A, 17-17 (2020/1-1)

Rotation of molecular clouds in M 51.

BRAINE J., HUGHES A., ROSOLOWSKY E., GRATIER P., COLOMBO D., MEIDT S. and SCHINN

Simbad objects: 3

[2020A&A...633A.144V](#) [X D ,89]

Astronomy and Astrophysics, volume 633A, 144-144 (2020/1-1)



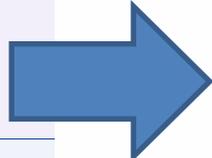
https://vizier.u-strasbg.fr

Find cat: available

Catalog, author's name, word(s) from title, description, etc. e.g.: AGN, Veron, I/239, or bibcodes...
 Search for catalogs by column descriptions (UCD)
 Search for catalogs containing additional data

Search by: 2386 tables

Target Nbr: or Position: Target dimension:



List of catalogs

<input type="checkbox"/>	I/350	Gaia EDR3 (Gaia Collaboration, 2018) acknowledge and cite Gaia EDR3
<input type="checkbox"/>	I/345	Gaia DR2 (Gaia Collaboration, 2018) acknowledge and cite Gaia DR2
<input type="checkbox"/>	I/347	Distances to 1.33 billion stars in Gaia DR2 (Bailer-Jones+, 2018)
<input type="checkbox"/>	I/324	The Initial Gaia Source List (IGSL) (Smart, 2013)
<input type="checkbox"/>	I/337	Gaia DR1 (Gaia Collaboration, 2016) acknowledge and cite Gaia DR1
<input type="checkbox"/>	VI/145	ASC Gaia Attitude Star Catalog (Smart, 2015)

Query form

[I/350](#) Gaia EDR3 (Gaia Collaborative) [Post annotation](#)

1.I/350/gaiaedr3 Gaia data early release 3 (Gaia EDR3). (Download all Gaia Sources as VOTable, FITS or find_gaia_edr3 available in cdsclient [here](#)) (original column names in green) (1811709771 rows)

Simple Constraint List Of Constraints

Query by Constraints applied on Columns (Output Order: + -)

Standard Original

Show	Sort	Column	Clear	Constraint	Expl
<input type="checkbox"/>	<input type="radio"/>	EDR3Name	<input type="text"/>	(char)	Unique source designation (unique across all Data Release 3)
<input checked="" type="checkbox"/>	<input type="radio"/>	RA_ICRS	<input type="text"/>	deg (i)	Barycentric right ascension of the source (ICRS) at Epoch t_0
<input checked="" type="checkbox"/>	<input type="radio"/>	e_RA_ICRS	<input type="text"/>	mas (mas)	Standard error $e_{RA} = RA * \cos DE$ of the right ascension of the source (ICRS) at Epoch t_0 (stat. error, pos. eq. ra)
<input checked="" type="checkbox"/>	<input type="radio"/>	DE_ICRS	<input type="text"/>	deg (i)	Barycentric declination of the source (ICRS) at Epoch t_0
<input checked="" type="checkbox"/>	<input type="radio"/>	e_DE_ICRS	<input type="text"/>	mas (mas)	Standard error of the declination of the source in ICRS at Epoch t_0
<input checked="" type="checkbox"/>	<input type="radio"/>	Source	<input type="text"/>	(i)	Unique source identifier (unique within a particular Data Release)
<input type="checkbox"/>	<input type="radio"/>	SolID	<input type="text"/>		Solution Identifier (solution_id) (Note 3) (meta_version)
<input type="checkbox"/>	<input type="radio"/>	RandomI	<input type="text"/>	(i)	Random index used to select subsets (random_index)
<input type="checkbox"/>	<input type="radio"/>	Epoch	<input type="text" value=">1"/>	d (i)	Reference epoch (ref_epoch) (Note 5) (meta_ref_time)
<input checked="" type="checkbox"/>	<input type="radio"/>	Plx	<input type="text" value=">"/>	mas (mas)(i)	Absolute stellar parallax of the source at the Epoch t_0

- The VizieR service contains 20,500 catalogues, published tables, and observation logs
- Daily updated by CDS documentarists & astronomers from astronomical literature & mission catalogs
- C + Java + Postgres DB
- 2 main developers (F.Ochsenbein, G.Landais)
- Linked to CDS Xmatch tool (FX.Pineau)

Object tables

Full name	RA 2000	DE J2000	RA ICRS	e
arcmin	"h:m:s"	"d:m:s"	deg	mas
1	00.0024	00.05 08.8405444246	+67 50 23.980501544	0.0406
2	0.0784	00.05 09.4411117667	+67 50 20.971132609	0.0108
3	0.2202	00.05 07.1293963903	+67 50 32.965055430	0.3414
4	0.2272	00.05 10.2928394826	+67 50 34.765283803	1.5360
5	0.5177	00.05 08.5052328122	+67 50 54.999421196	1.2891
6	0.7941	00.05 00.4530969684	+67 50 19.188041914	0.5265
7	0.7954	00.05 17.0589265708	+67 50 13.193940911	0.0233
8	0.8247	00.05 00.1092553144	+67 50 20.418624372	0.3449
9	1.1099	00.05 15.6324884435	+67 49 29.556921691	0.5021
10	1.1291	00.05 01.1418356277	+67 51 15.852754562	0.6470
11	1.1454	00.05 10.4094472656	+67 49 15.847216912	0.0737
12	1.2007	00.05 21.0381332306	+67 50 03.467187804	1.1491
13	1.2812	00.05 14.8007094298	+67 49 14.883754671	0.3132
14	1.4356	00.05 12.4481349954	+67 51 47.687206152	0.4050
15	1.6163	00.04 55.4470010629	+67 51 24.509044082	0.6071
16	1.6727	00.05 05.7879861077	+67 48 45.089231152	0.9095
17	1.6730	00.05 26.5673855614	+67 50 28.043601743	0.4839
18	1.6839	00.05 17.9448412205	+67 51 50.902044767	0.2596
19	1.7103	00.05 14.5813534586	+67 48 46.759820711	0.0123
20	1.7525	00.05 20.4095380858	+67 51 46.142386686	0.5330



<https://aladin.u-strasbg.fr>

http://aladin.u-strasbg.fr/ x +

aladin.u-strasbg.fr

Rechercher

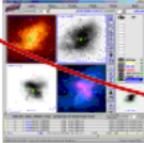
Portal Simbad VizieR **Aladin** X-Match Other Help

Aladin sky Atlas

- Overview
- Aladin Desktop
- Aladin Lite
- Information
- en français

Overview

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.

 Download **Aladin Desktop** on your machine

 Preview with **Aladin Lite** in your browser

The *Aladin sky atlas* is available in two modes: *Aladin Desktop*, a regular application and *Aladin Lite* an HTML5 javascript web widget.

□ Aladin technology evolution

1995

Proto XWindows (C++)

2000

Applet (java)

2003

Standalone/Applet (java)

2013

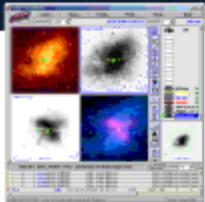
Aladin Lite (javascript)

Aladin Desktop (java)

2020

Aladin Lite v3 (typescript+webgl)

□ Aladin Sky Atlas, one in two!



Aladin Desktop

- high level features **desktop**
- access images, catalogs, footprints
- **full range of functionalities**
- interoperable with VO tools
 - Aladin is a VO portal
 - used to validate most standards
- Used for observation preparation tools (APT, GuideCam)
- going all hierarchical now! (HiPS)



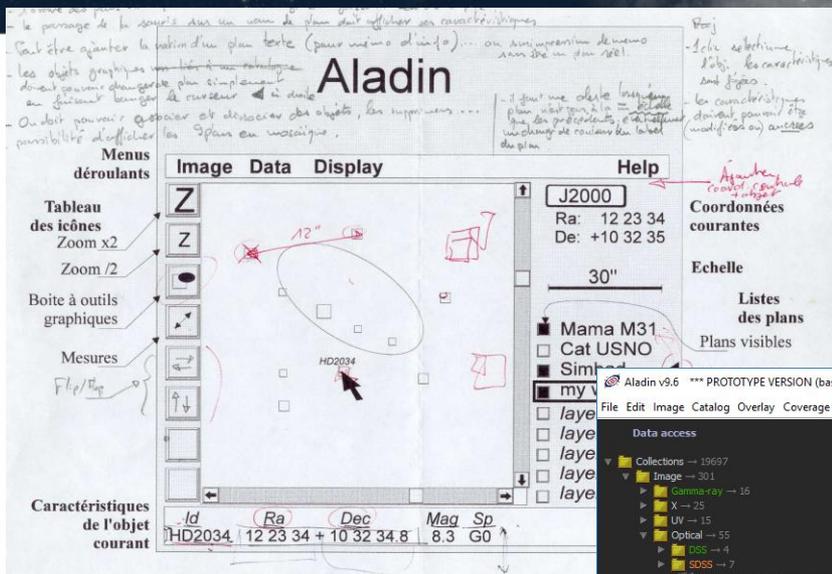
Aladin Lite

- **Web** HiPS visualizer
- preview mode
- embed in any webpage
- **easy appropriation**
- **highly used in wide range of sites/services**
- basic functions... but more and more!

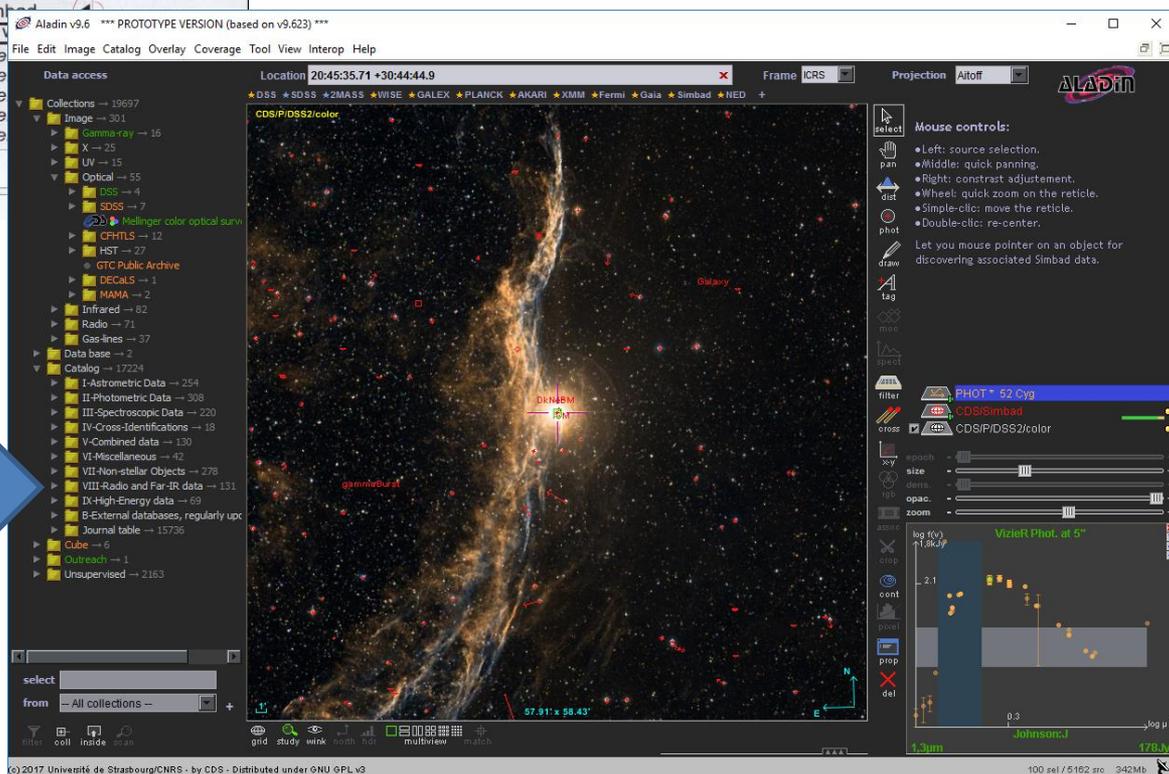
□ Key figures on Aladin Desktop

- 1. Started in 1999**
- 2. Code: 5MB jar, 250k source lines, 500 classes**
 - only based on CDS & JDK regular libraries
 - 5 main developers (P. Fernique, T. Boch, Chaitra, A. Oberto, F. Bonnarel)
+ dozen of contributors
- 3. Usage: 1k sessions per day for 180k http queries**
(HiPS tiles queries included)
- 4. Language: 86% en, 8% fr, 3% jp, 1% es, 0.5% cn ..**
- 5. Java: 64% 1.8, 18% 11.0, 12% 1.7, 2% 10.0, ...**

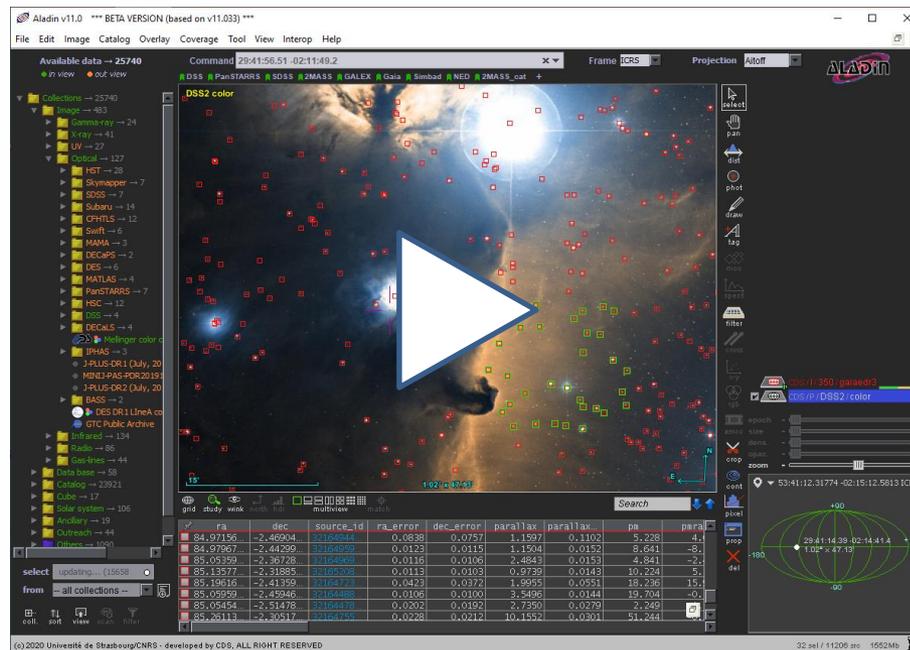
Aladin Desktop – 22 years old



Aladin v0 - 1999



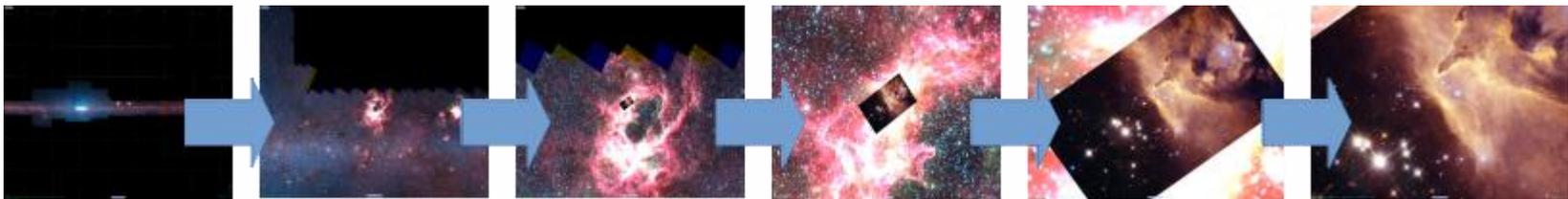
□ The basis of Aladin



Demo2 with comments

□ New context – new feature

2009 - The HiPS (r)evolution



□ Browsing the sky...

- 2001 **Virtual Sky** <http://www.virtualsky.org>
- 2006 **Wikisky/sky-map** <http://sky-map.org>
- 2006 **World wind** <http://worldwind.arc.nasa.gov>
- 2007 **Google sky** <http://earth.google.com>
- 2008 **WWT** <http://www.worldwidetelescope.org>
- 2008 **VIRGO** <http://archive.eso.org>
- 2009 **Aladin** <http://aladin.u-strasbg.fr>

=> 21st century tools

□ The 4 main issues

1. The size of data (server-side, via internet, client-side)
2. The client display performances
3. The data base structure (storage and retrieval)
4. The sky projection/distorsion



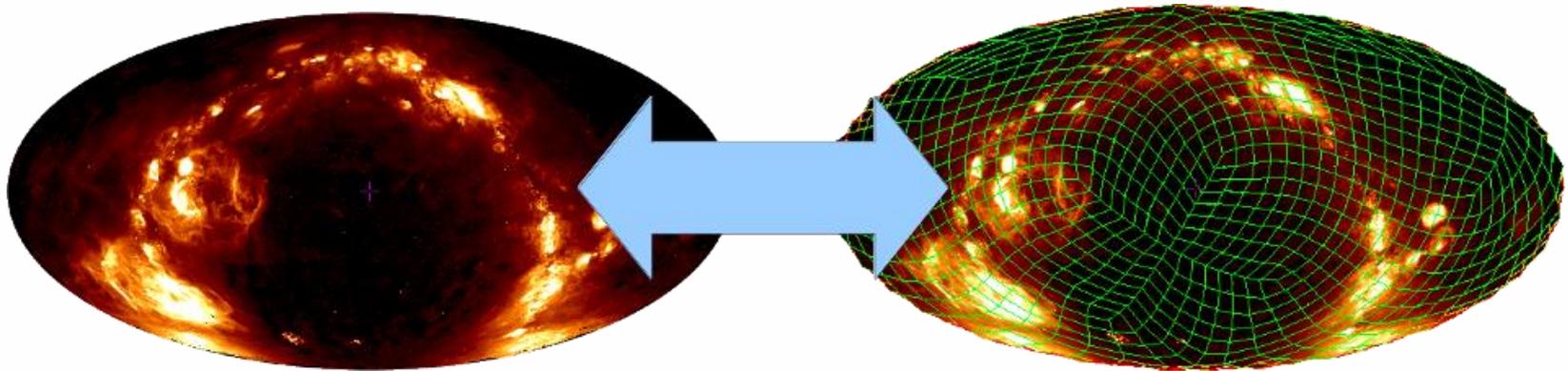
□ 1) Data size...

- DSS2: 1 arcsec/pixel resolution survey
 - => 500 billions pixels = 1 TB in 16 bits/pixel
 - => 70 GB in JPEG
- Resampling whole DSS2 takes a few days of elapsed time for computation on a basic machine
- A few MB in a second via internet

“Traditional” surveys not so big today !

□ 2) Client display performances...

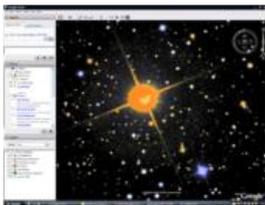
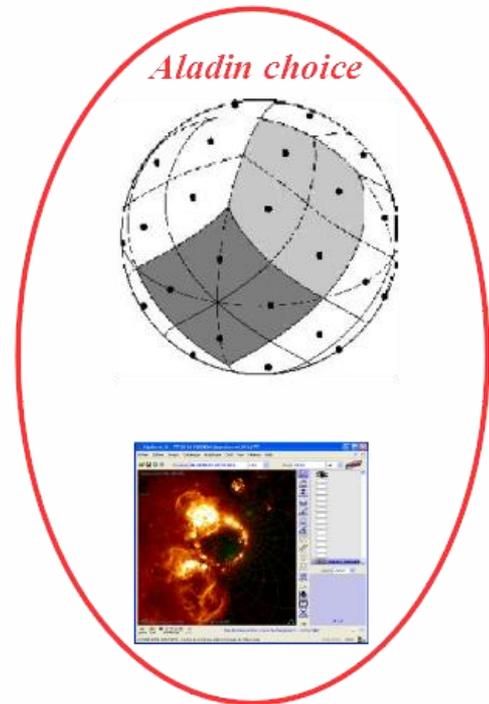
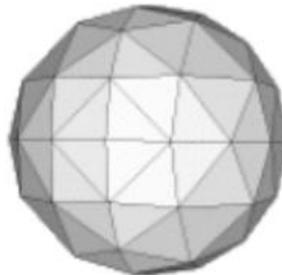
- Current graphics cards require $<1\text{ms}$ for projecting 1million pixels (bilinear method)
 - => 10 ms for redrawing an all sky view with one thousand (64x64) mosaic images



=> You can drag&drop the sky with the mouse
=> Thanks to computer games

□ 3 & 4) How to « divide » the sky ?

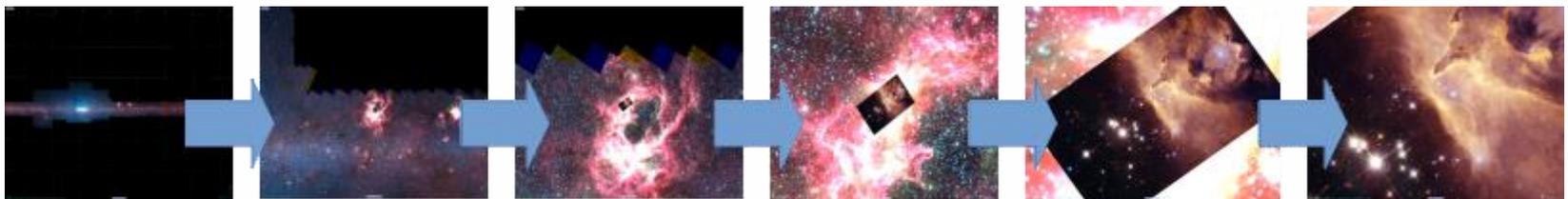
- Server database => get a good spatial index
- Client => get an efficient display (poles ?, pixel value ?...)



□ HiPS – What is it ?

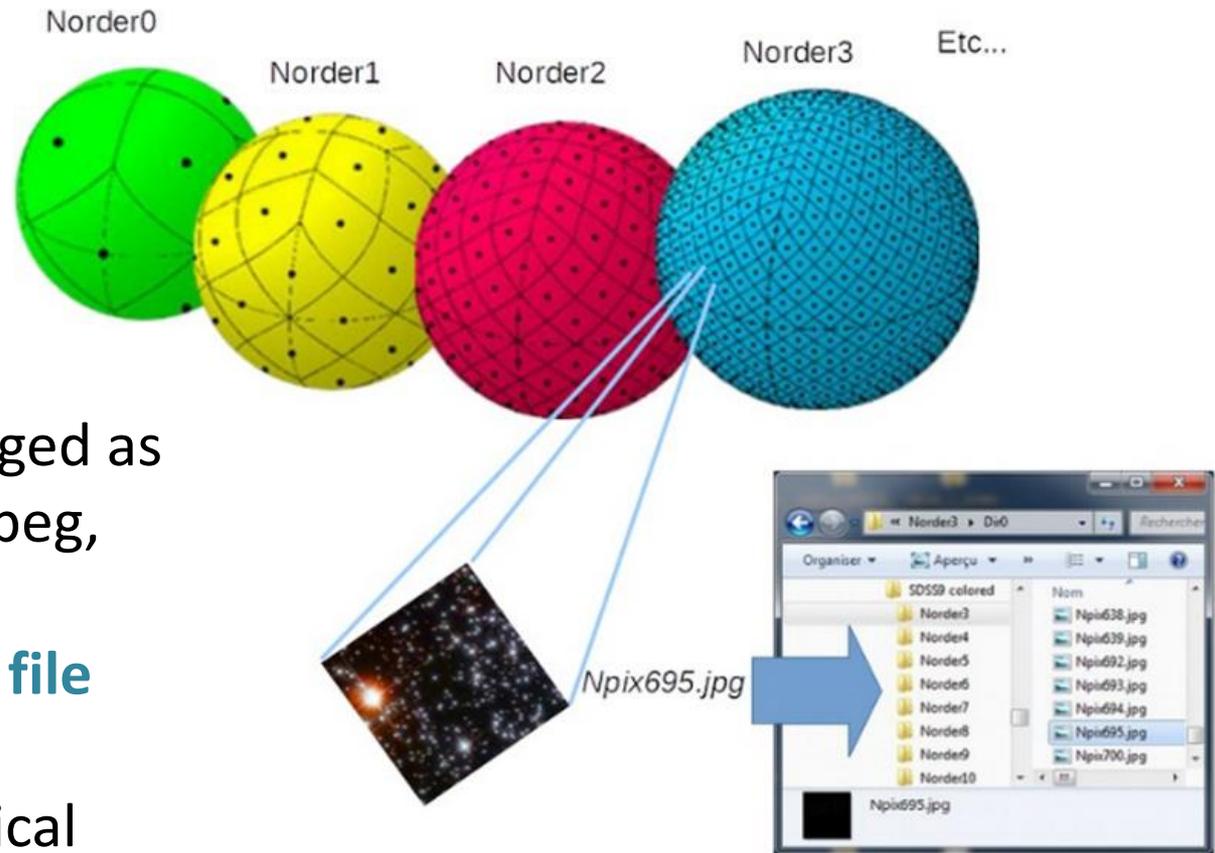
Hierarchical Progressive Survey

- *“The more you zoom in on a particular area, the more details show up”*
- **Multi-resolution HEALPix** data structure for Images, Catalogues, 3-dimensional data cubes, ...
- **Conserves scientific data properties** alongside visualisation considerations
- No databases or dedicated servers are required, just HTTP



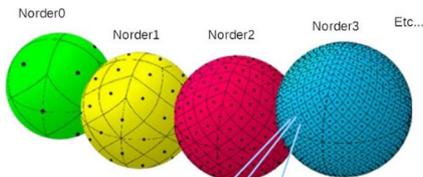
□ HiPS principles

- A global **resample** of a survey **in HEALpix** grid at various resolutions
- Resulting pixels packaged as **tiles in regular files** (jpeg, png, fits)
- Tiles **stored in a basic file system**
- **Distributed** by a classical **HTTP server** (ie. Apache)



□ HiPS time line

2009 2010 2011 2012 2013 2014 2015 2016 2017



IVOA HiPS 1.0

IVOA standardization

HiPS network

ESAsky, JUDO2, ...

A&A article

ADASS talk

HiPS cube, cat, ...

CDS Aladin lite

Mizar/CNES client

Proto in CDS Aladin Desktop

ADASS talk

Start of the story at CDS

by A. Oberto, P. Fernique, T. Boch & Al.

HiPS 2021

1. An IVOA standard
2. A collaborative HiPS networks
3. Dozens of HiPS clients



HIPS – Hierarchical Progressive Survey

Version 1.0
IVOA Recommendation
19th May 2017

This version:
 1.0 Recommendation 2017-05-19

Previous version(s):
 1.0 Proposed Recommendation 2017-04-06
 1.0 Proposed Recommendation 2017-04-03
 1.0 Proposed Recommendation 2017-02-07
 1.0 Proposed Recommendation 2016-11-22
 1.0 Working Draft 2016-06-23

InterestWorking Group:
 Applications: <http://www.ivoa.net/wiki/bin/view/IVOA/IvoaApplications>

Editor:
 Pierre Fernique

Authors:
 Pierre Fernique, Mark Allen, Thomas Boch, Tom Donaldson, Daniel Durand, Ken Eblewae, Laurent Michel, Jesus Salgado, Felix Stoehr

Abstract

This document presents HIPS, a hierarchical scheme for the description, storage and access of sky survey data. The system is based on hierarchical tiling of sky regions at finer and finer spatial resolution which facilitates a progressive view of a survey, and supports multi-resolution zooming and

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HiPS nodes

- **20** HiPS nodes (stable compared to last year)
 CFA, WFAU, CASDA, PADC, IPAC, ANU, LEIDEN, IRAP, SSC, CDS, AMIGA, SVO, IAS, ESAC, JAXA, CADC, HEASARC, China-VO...

+ dozens of undeclared HiPS nodes (private, project oriented...)

→

- www.sternwarte.uni-erlangen.de
- www.eaobservatory.org
- www.eao.hawaii.edu
- www.atnf.csiro.au
- mill.astro.puc.cl
- lofar.strw.leidenuniv.nl
- gtc.sdc.cab.inta-csic.es
- erosita.mpe.mpg.de
- elenchically.net
- datalab.noao.edu
- darts.isas.jaxa.jp
- archive-new.nrao.edu
- ada.physics.usyd.edu.au:8021
- ada.physics.usyd.edu.au:8020
- 192.168.56.1:80
- 192.168.56.100:80
- 192.168.2.45

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Dozens of HiPS clients covering various niches



- **Available**
 - Aladin Desktop (CDS/Java)
 - MIZAR (JS/WebGL)
 - Aladin Lite (CDS/JS)
 - ESAsky, ESOportal, JUDO2, ++ (Aladin Lite based tools)
 - HscMap (Subaru project/WebGL)
 - Stellarium Desktop (C)
 - Stellarium Web (C -> Web assembly)
 - Stellarium mobile (?)
 - Kstar (C++)
 - Firefly (IPAC/JS+java backend)
- **Proto**
 - WWT China-VO (China-VO/CH)
- **In preparation**
 - Aladin Lite WebGL (CDS/JS/WebGL/RUST)
 - Digistar (?)

- Scientific purpose
- Planetarium control
- Amateurs
- Public

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HiPS list aggregator

List of Hierarchical Progressive Surveys provided by all public HiPS servers

This page provides the list of all public HiPS sorted by categories (HiPS sky maps, HiPS planet maps, HiPS cubes, HiPS catalogs), plus the list of the public HiPS servers. It is based on the CDS MocServer used to aggregate HiPS lists.

HiPS servers (list of HiPS HTTP servers - required a VO registration)

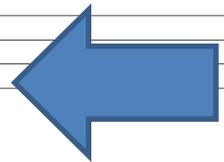
<http://aladin.unistra.fr/hips/registry>

#	Origin	Type	HiPS list URL
1	hips.astron.nl	image	http://hips.astron.nl/hipslist
2	jvo	image	http://jvo.nao.ac.jp/HiPS/hipslist.txt
3	CEFCA	image, catalog	https://archive.cefca.es/catalogues/hips_list.html
4	cfa.harvard.edu	image	https://cdfstp.cfa.harvard.edu/hipslist
5	ufau.roe.ac.uk	image, catalog	http://europa.roe.ac.uk/hips74/hipslist

4. And a lot of HiPS surveys

<http://aladin.u-strasbg.fr/hips/list>

13	CDS	image, cube	http://alaska.unistra.fr/hipslist
14	CDS	image, cube	http://alaskybis.unistra.fr/hipslist
15	CDS	image, cube	https://alaskybis.unistra.fr/hipslist
16	CDS	catalog	http://axel.u-strasbg.fr/HiPSCatService/hiplist
17	AMIGA		http://amiga.iaa.es/hipslist
18	svo.cab	image	http://gtc.sdc.cab.inta-csic.es/hips/hipslist
19	IAS	image	http://healpix.ias.u-psud.fr/hipslist
20	ESAC	image	http://skies.esac.esa.int/hipslist
21	JAXA	image, catalog	http://darts.isas.jaxa.jp/pub/HiPS/hipslist.txt
22	CADC	image	http://hips.canfar.net/hipslist.txt
23	HEASARC	image	https://skyview.gsfc.nasa.gov/hips/skyview.hips
24	China-VO	image	http://hips.china-vo.org/hipslist



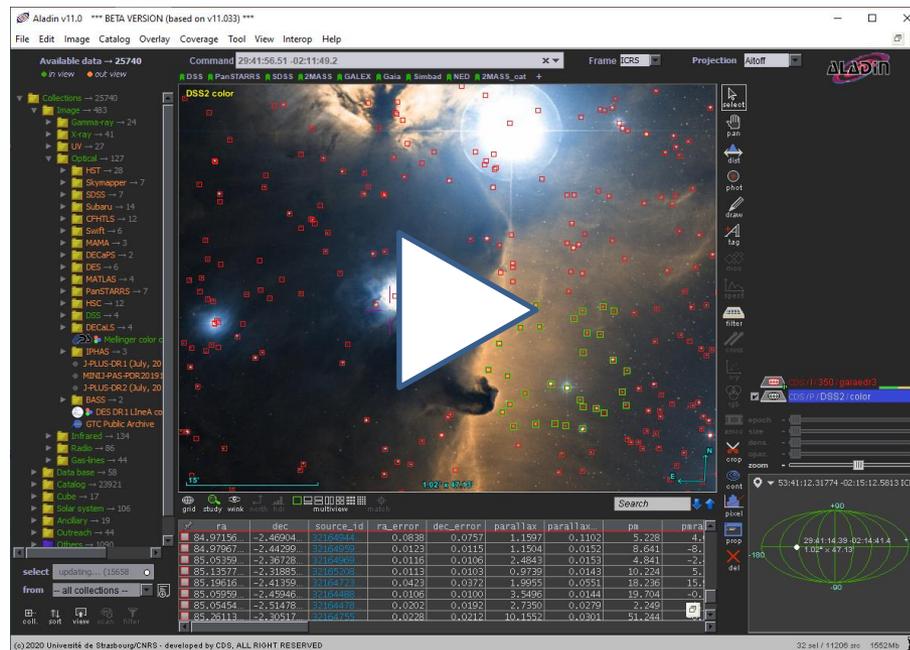
1) HiPS sky maps

[http://alaska.unistra.fr/MocServer/query?expr=\(hips_frame%3Dequatorial%2Ggalactic%2Ceccliptic+|+hips_frame%3D!*\)+%26%26+dataprodtype!%3Dcatalog%2Ccube+%26%26+hips_service_ur!%3D*&get=record](http://alaska.unistra.fr/MocServer/query?expr=(hips_frame%3Dequatorial%2Ggalactic%2Ceccliptic+|+hips_frame%3D!*)+%26%26+dataprodtype!%3Dcatalog%2Ccube+%26%26+hips_service_ur!%3D*&get=record)

#	ID	Mirror sites	Last modif	HiPS order	HiPS frame	Coverage	Tile format	Mode	Progen	Pixels
1	ASTRON/P/apertif_dr1		2020-11-11	7	equatorial	0.04466	png, fits		yes	6Gpix
2	CDS/P/2MASS/H	4	2019-05-07	9	equatorial	1	jpeg, fits			2Tpix
3	CDS/P/2MASS/J	5	2019-05-07	9	equatorial	1	jpeg, fits		yes	2Tpix
4	CDS/P/2MASS/K	5	2019-05-07	9	equatorial	1	jpeg, fits		yes	2Tpix

- **1034** HiPS
- **2483** instances (masters + mirrors)
- **370TB** of HiPS
- **around 800K** tile queries per day

HiPS manipulation with Aladin



Demo1 with comments

□ My conclusion

- Always Data first
- Hurry up “slowly” on new technology
- Let be surprised by young people's ideas



Questions ?