What's new at CDS ?

Sébastien Derriere
(and the CDS team !)

Séminaire du 12 avril 2019

Observatoire **astronomique**
de Strasbourg | ObAS

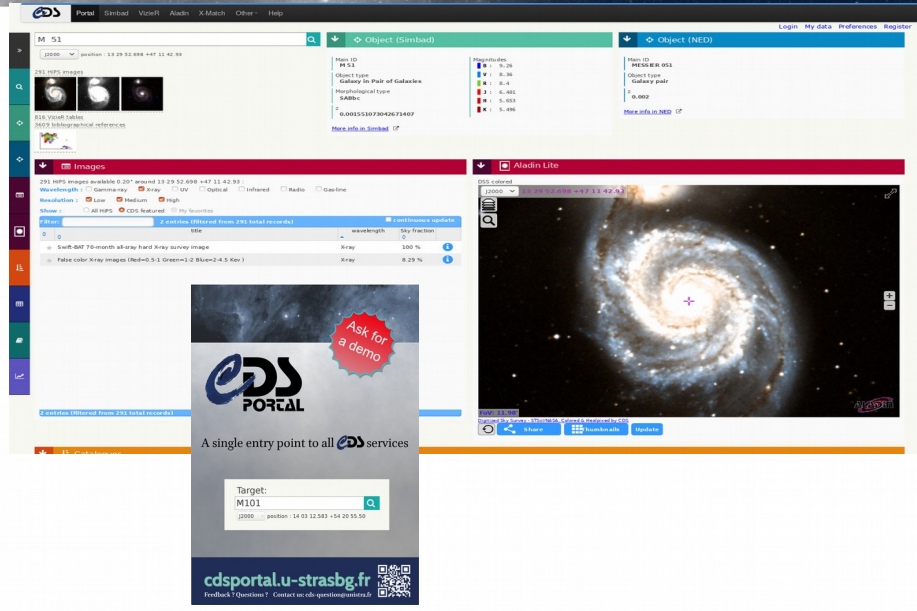
Foreword

- What I will not describe in this talk
  - How documentalists work, or the internal tools used to feed the services on a daily basis. But keep in mind this remains at the core of everything else !
  - The science that is produced by CDS scientists
  - Latest prototypes being developed (R&D)
- What I will focus on
  - Highlighting some recent features, or services you might not know exist
  - Try to answer various useful questions, with live demos
- And I hope you will
  - Discover new possibilities
  - Spread the word and become « CDS ambassadors »

You probably already know about CDS

SIMBAD

VizieR



ALADIN

The « demo booth effect »

- CDS booth at AAS

You guys are doing a great job !
I use SIMBAD everyday !!

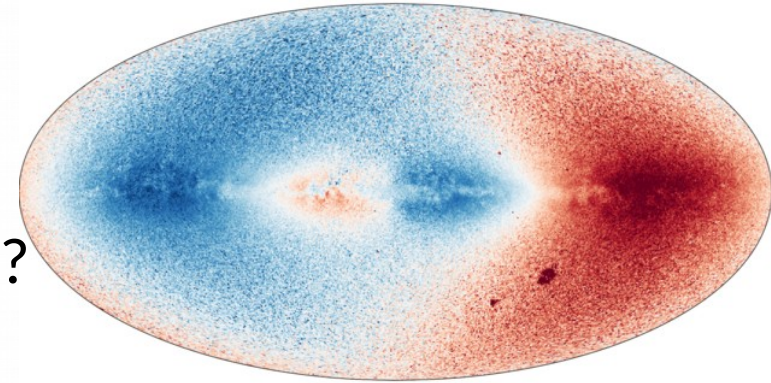
Do you have 5 minutes
for a demo ?

… 20 minutes later ...

OMG this is amazing !
I had no idea you could do that.
I have to tell my students...

How can CDS tools help you… ?

- Find what region has been observed by SDSS and GALEX and HST (V band) ?
  - And use this region to query a VizieR catalogue ?
- Publish a collection of images, cubes ?
- Reproduce the Gaia DR2 radial velocity map ?
- Visualize the rotation of the LMC ?



- Know when new papers dealing with your favourite object are added in SIMBAD ?
- Display the positions, names and V magnitudes for QSOs brighter than V=18 located within 10 degrees of the north equatorial pole
- Find the 10 most studied objects in MNRAS in 2015 ?

Plan

- All-sky approach : HiPS and MOC
- Aladin Desktop v10 : (some) new capabilities
- Creating custom HiPS, and usage of Aladin Lite
- Table Access Protocol (TAP) for advanced queries
- CDS and you : login, annotations, tutorials, social media, SimWatch, ...

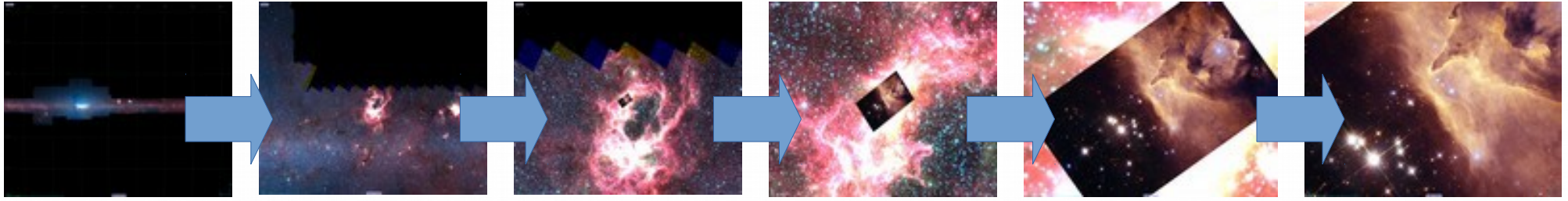
All-sky approach : a paradigm shift

- From pointed images (or cutouts) : *show me the 2MASS image of M87*…
- … to all-sky : *show me the 2MASS survey*, centered on M87
  (possible access to progenitors)

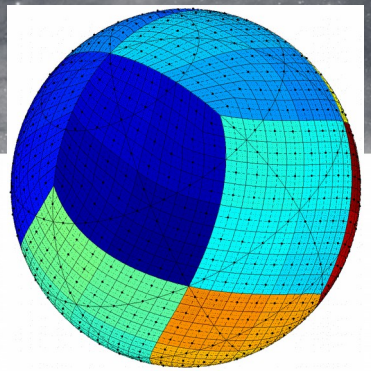
→ Enabled by HiPS
… and MOC

What is HiPS ?

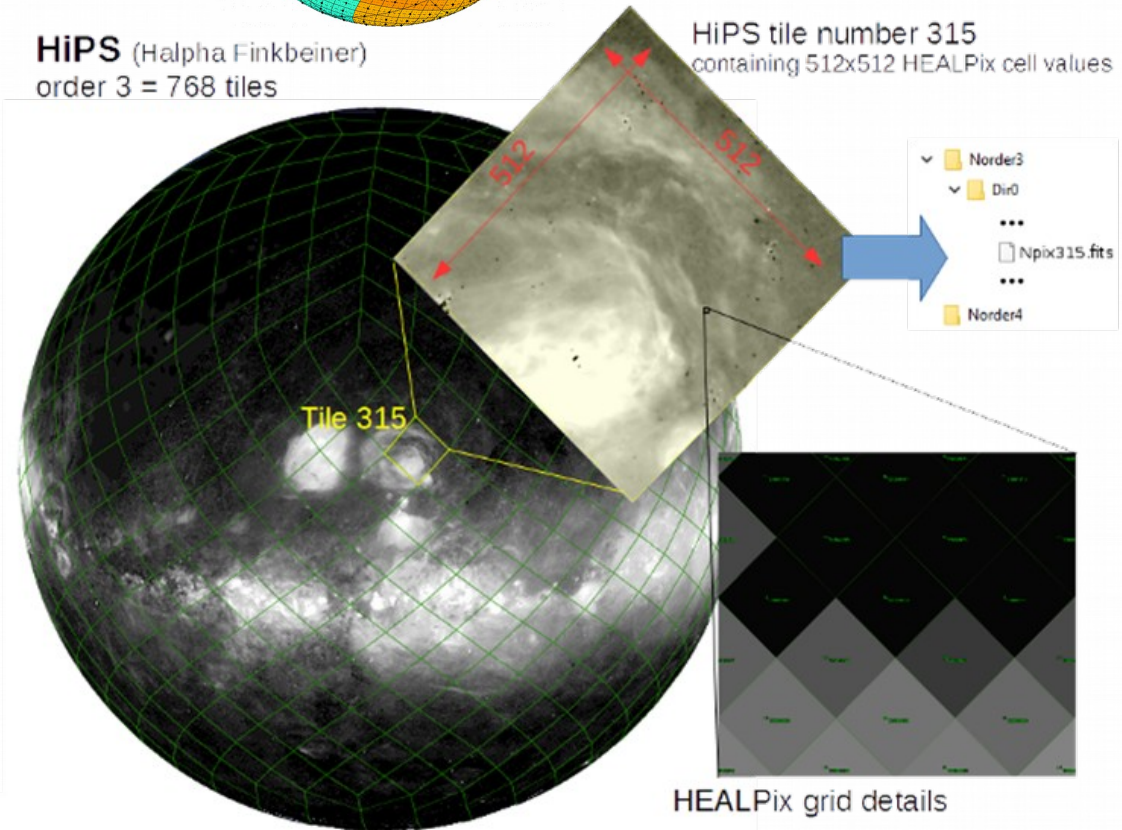
- Hierachical Progressive Survey
  "The more you zoom in on a particular area, the more details show up"
- Multi-resolution HEALPix data structure
  for Images, Catalogues, 3-dimensional data cubes, ...
- Conserves scientific data properties alongside visualisation considerations
- No databases or servers, just HTTP



What is HiPS ?

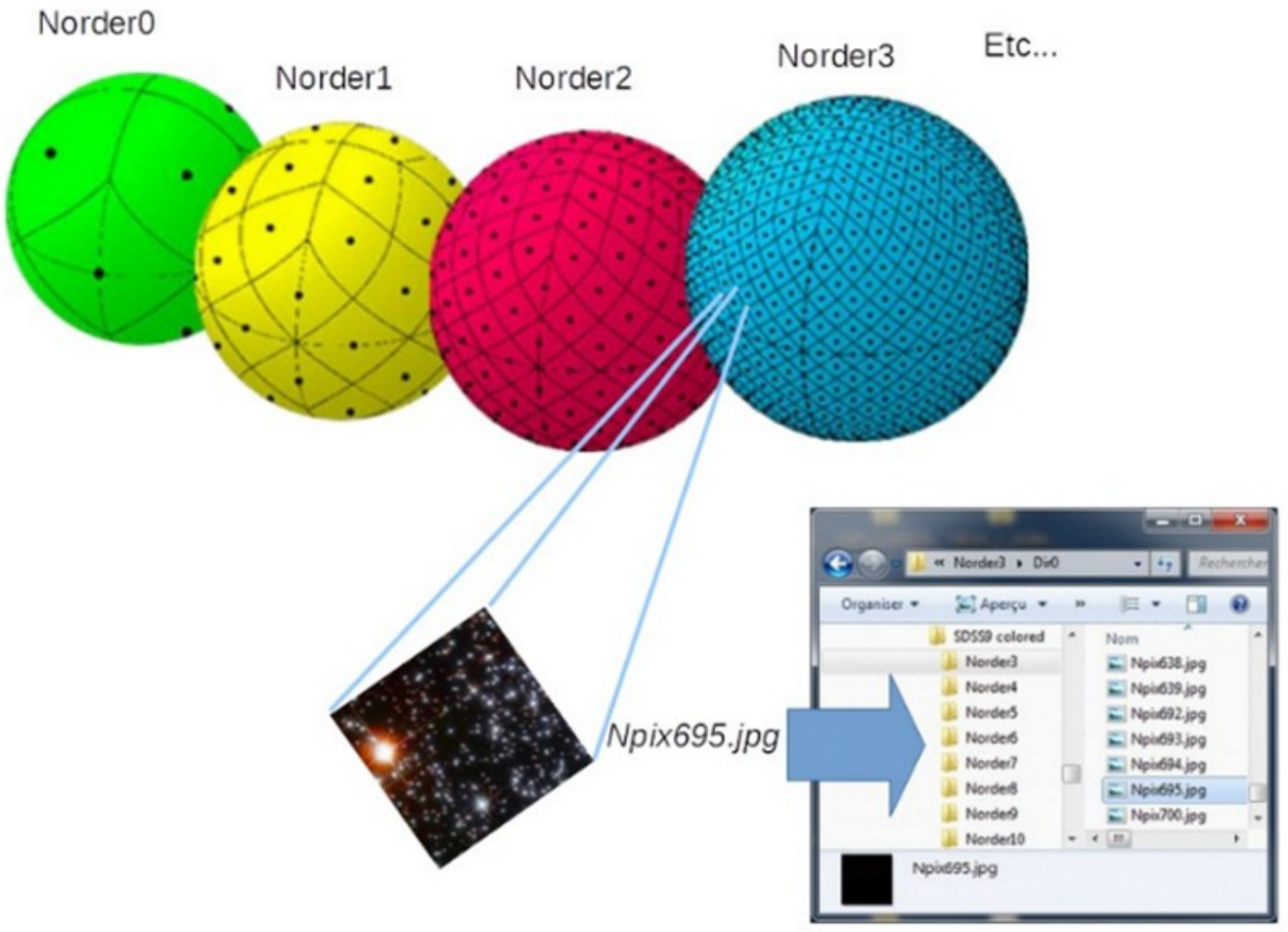


- HEALPix (Gorski et al. 2005)
  - **12 quadrilateral pixels**
  - 2x2 division at each level
  - **Equal area,** Iso-latitude
- HiPS = Mosaic of HEALPix tiles (HEALPix pixel geometry)



What is HiPS ?

- HiPS = Collection of tiles as files.



What is MOC ?

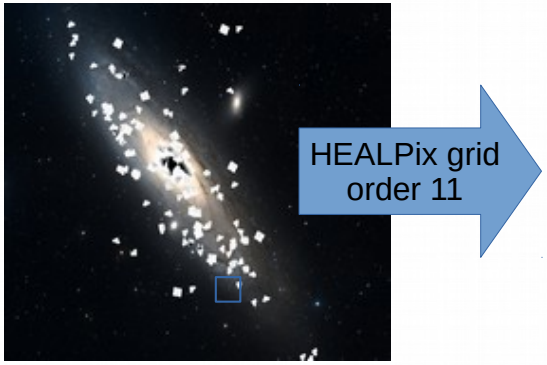
- Multi-Order Coverage map

  “Combine sky regions in few milliseconds”

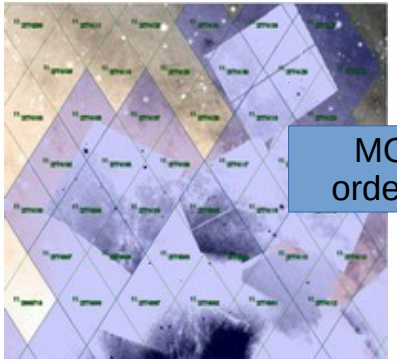
- A simple and efficient method to specify any kind of sky regions
- Based on HEALPix tessellation
- Existing libraries: Java, C, python
- Used in VO tools (Aladin, TOPcat, …)

What is MOC ?

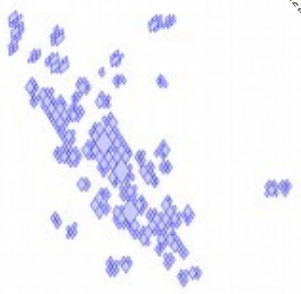
- “Just” the list of HEALPix cell numbers covering a region



HEALPix grid order 11



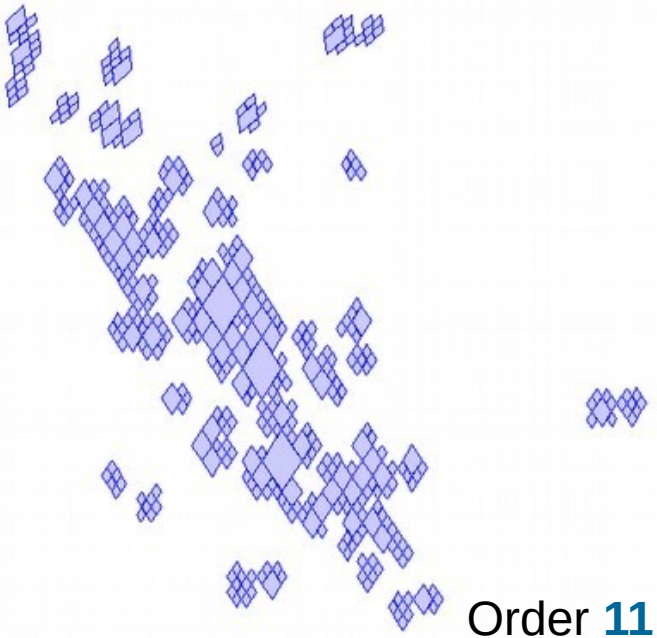
MOC order 11



- 4 adjacent cells are replaced by the parent, recursively
  → intrinsic compression
- Store as a FITS table (or JSON)

What is MOC ?

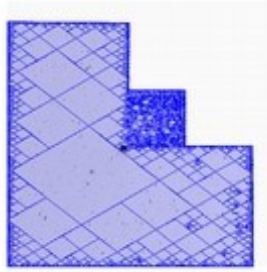
- MOC accuracy depends of the MOC **order**
  = the smallest HEALPix cell level used in the MOC



Order **11**
=>1.718 arcsec

Order **20**
=>201.3mas

• • •



Order **29**
=>391 µas

IVOA standards

International Virtual Observatory Alliance

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: Working Draft 2016-06-23

Interest/Working Group:
Applications: http://www.ivoa.net/twiki/bin/view/IVOA/IvoaApplications

Editor:
Pierre Fernique

Authors:
Pierre Fernique, Mark Allen, Thomas Boch, Tom Donaldson, Daniel Durand, Ken Ebisawa, 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

1

International Virtual Observatory Alliance

MOC – HEALPix Multi-Order Coverage map
Version 1.0
IVOA Recommendation 2 June 2014

This version:
1.0: Recommendation 2014-06-02

Previous version(s):
None

Interest/Working Group:
Applications: http://www.ivoa.net/twiki/bin/view/IVOA/IvoaApplications

Editor:
Pierre Fernique

Authors:
Thomas Boch, Tom Donaldson, Daniel Durand, Pierre Fernique, Wil O'Mullane, Martin Reinecke, Mark Taylor

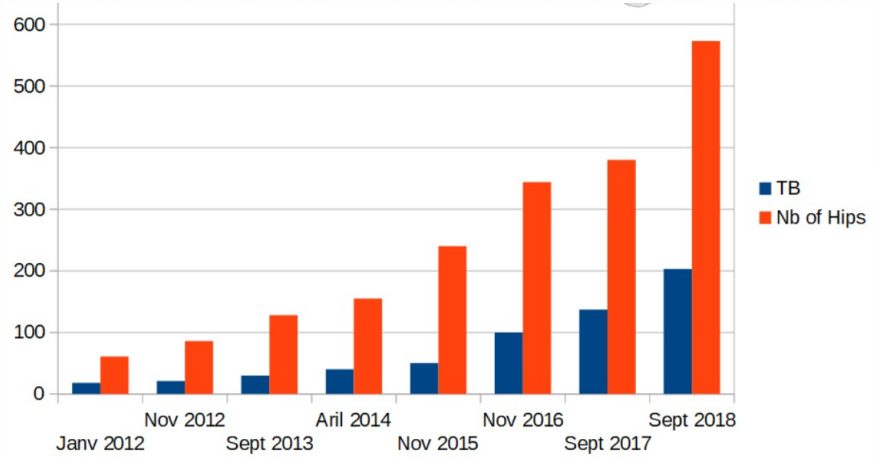
Abstract

This document describes the Multi-Order Coverage map method (MOC) to specify arbitrary sky regions. The goal is to be able to provide a very fast comparison mechanism between coverage maps. The mechanism is based on the HEALPix sky tessellation algorithm. It is essentially a simple way to map regions of the sky into hierarchically grouped predefined cells.

1

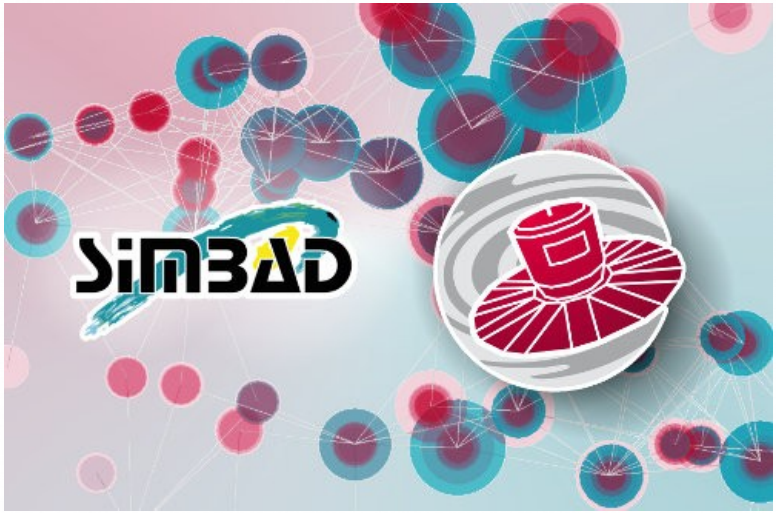
HiPS and MOC in Aladin

- 500+ image surveys in HiPS
  - And planetary maps
- Computed by CDS, and other data centers
  - Make your own HiPS from FITS files !
- MOC tell you which datasets are available locally
- Generate PNG or JPG versions for use in Aladin Lite

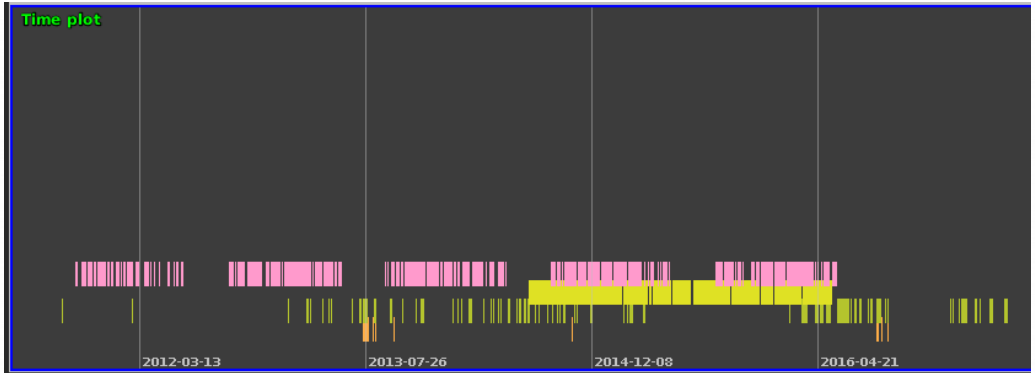


Progressive catalogues, TMOC

- Hierarchical progressive versions of catalogues can be prepared
  - As you zoom in, more and more sources are displayed
  - The ranking of the sources can be chosen : brightness, parallax, number of citations, custom scoring function…
  - Useful to display very large catalogues (Gaia DR2)



- TMOC are being developed for describing time coverage

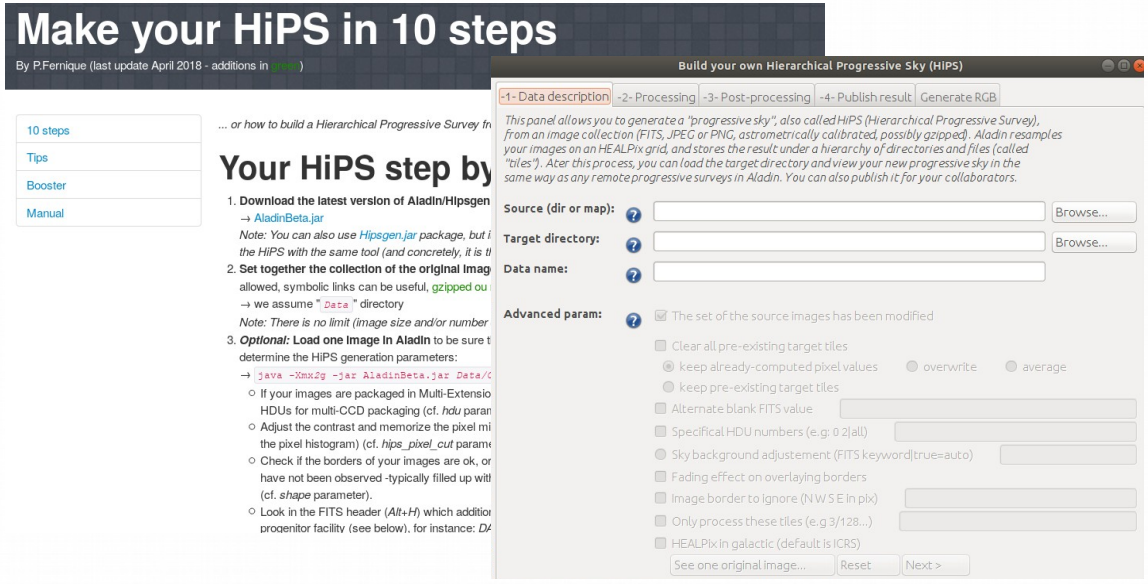


Demo 1

- Find what region has been observed by SDSS and GALEX and HST (V band) ?
  - And use this region to query a VizieR catalogue ?
- Publish a collection of images, cubes ?

HiPS everywhere ?

- Make your own HiPS



- With Aladin Lite, they can be easily embedded in web pages

→ http://aladin.u-strasbg.fr/AladinLite/doc/

Embedding in a web page

Terms of use: you are welcome to integrate Aladin Lite in your web pages and to customize its GUI to your needs, but please **leave the Aladin logo and link intact** at the bottom right of the view.

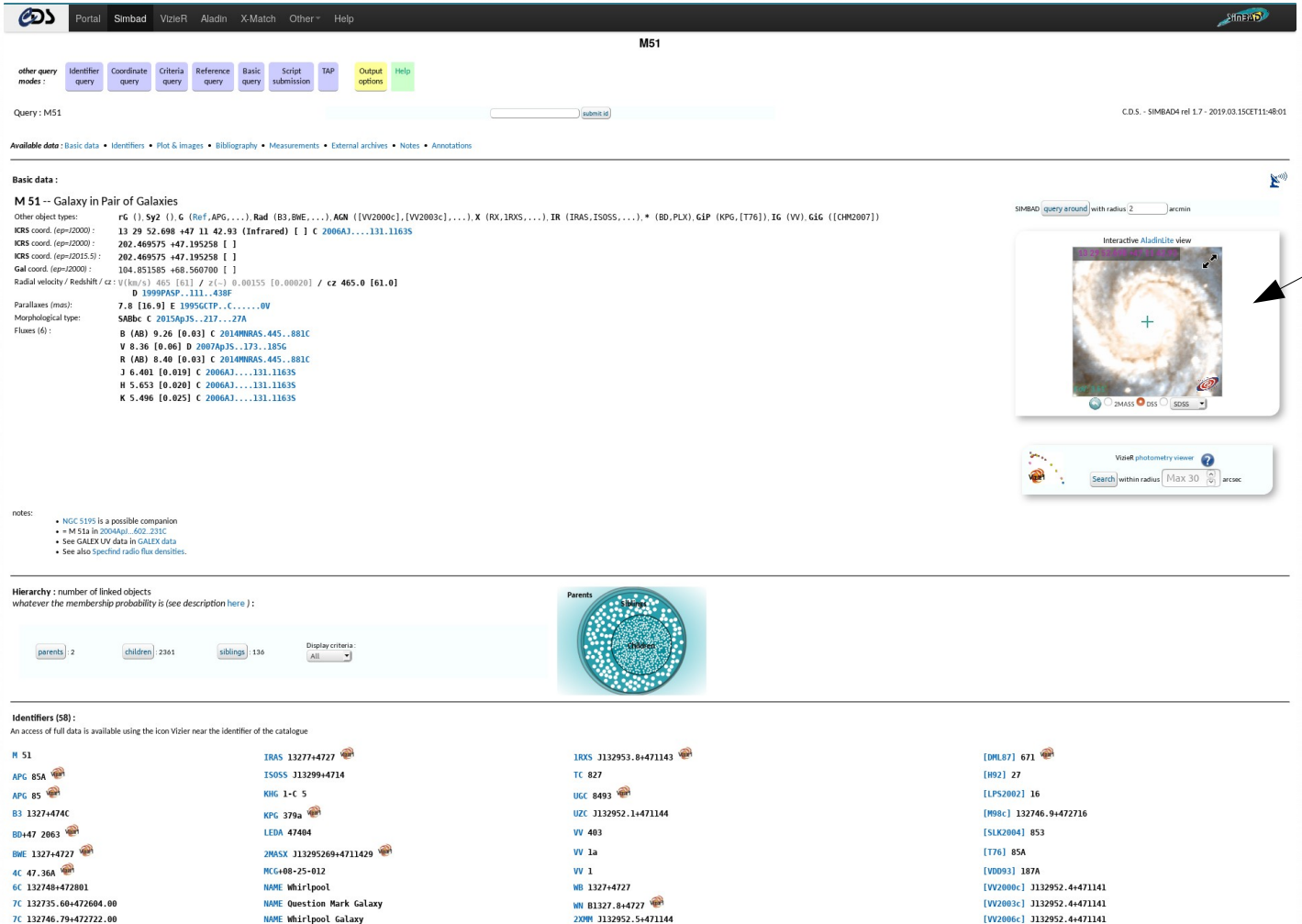
Choose options:

Width	400	px
Height	400	px
Image survey	DSS colored	
Initial location	Position or object name	
Initial FoV	60	degrees

Then copy/paste the following code in your page:

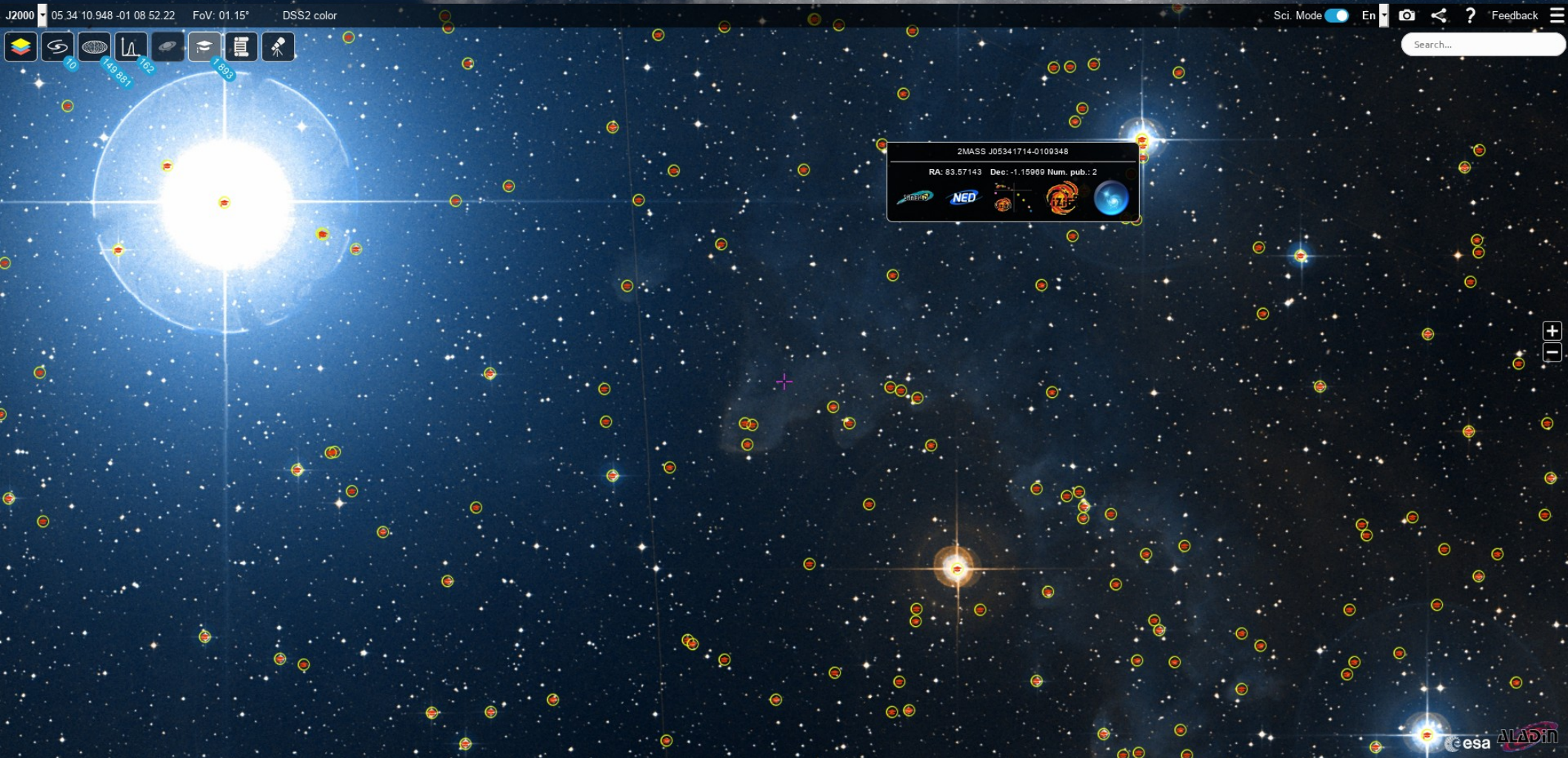
```
<!-- include Aladin Lite CSS file in the head section of your page -->
<link rel="stylesheet" href="//aladin.u-strasbg.fr/AladinLite/api/v2/latest/aladin.min.css" />

<!-- you can skip the following line if your page already integrates the jQuery library -->
<script type="text/javascript" src="//code.jquery.com/jquery-1.12.1.min.js" charset="utf-8"></script>

<!-- insert this snippet where you want Aladin Lite viewer to appear and after the loading of jQuery -->
<div id="aladin-lite-div" style="width:400px;height:400px;"></div>
<script type="text/javascript" src="//aladin.u-strasbg.fr/AladinLite/api/v2/latest/aladin.min.js" charset="utf-8"></script>
<script type="text/javascript">
    var aladin = A.aladin('#aladin-lite-div', {survey: "P/DSS2/color", fov:60});
</script>
```

HiPS in SIMBAD web pages



Aladin Lite

ESA Sky


J2000 05 34 10.948 -01 08 52.22 FoV: 01.15° DSS2 color
Sci. Mode
En
Feedback
Search...
10
149 881
162
1 893
2MASS J05341714-0109348
RA: 83.57143 Dec: -1.15969 Num. pub.: 2
NED
esa
ALADIN

Frontier Fields Catalogues

UNVEILING THE POWER OF THE DEEPEST IMAGES OF THE UNIVERSE

Documentation | ASTRODEEP homepage | HST Frontier Fields Survey at STScI

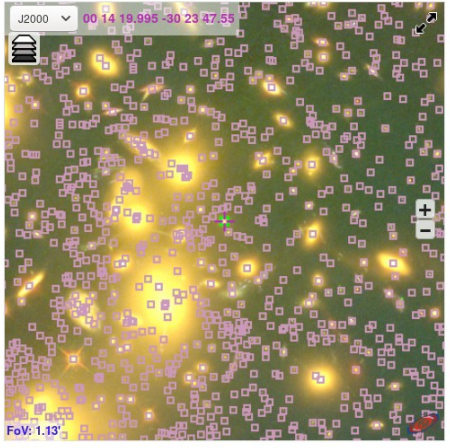
Abell 2744 and MACS J0416.1-2403 : Download the full catalogues | Papers : Merlin et al. 2016, Castellano et al. 2016

MACS J0717.5+3745 and MACS J1149.5+2223 : Download the full catalogues | Papers : Di Criscienzo et al. 2017

Available fields :

Abell 2744 Cluster | Abell 2744 Parallel | MACS J0416.1-2403 Cluster | MACS J0416.1-2403 Parallel | MACS J0717.5+3745 Cluster | MACS J0717.5+3745 Parallel | MACS J1149.5+2223 Cluster | MACS J1149.5+2223 Parallel

Abell 2744 Cluster



Color map: Native | Grayscale | Cubehelix | Eosb | Rainbow

Native colors

Display catalogue on Image

View your catalogues | Upload your catalogues (User: anonymous) | Help

Processed images:

B435 | V606 | I814 | Y105 | J125 | JH140 | H160 | Ks | CH1 | CH2

Original images:

B435 | V606 | I814 | Y105 | J125 | JH140 | H160 | Ks | CH1 | CH2

Color composition:

Color BIH | Color YKCH1

Details on source 1346

ID = 1346

J2000 = 3.583312 -30.396542

MAG_H160 = 22.016 ±0.0021

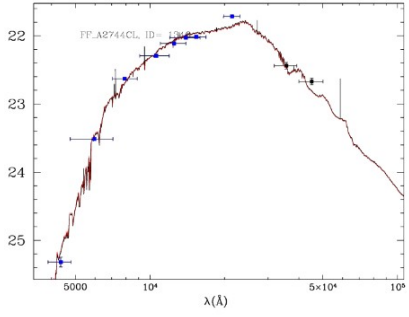
ZBEST = 0.452

MSTAR = 5.032 $10^9 M_\odot$

MAGNIF = 1.724

RELFLAG = 1

SED plot:



Connect to SAMP

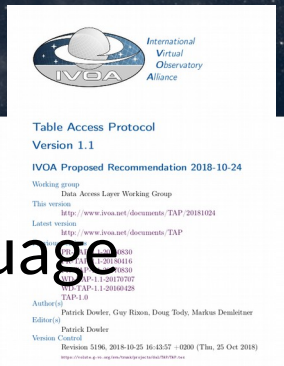
Portal for the ASTRODEEP project

Stellarium


HIP 27212
Affichage [F4]
Affichage
Ciel
DSO
Repères
Paysage
Culture céleste
Surveys
Ciel Profond
DSS colored
2MASS H (1.66um)
2MASS J (1.23um)
2MASS K (2.16um)
2MASS color J (1.23um), H (1.66um), K (2.16um)
2MASS6X color J (1.23um) & K (2.16um)
2MASS6X H (1.66um)
2MASS6X J (1.23um)
2MASS6X K (2.16um)
AKARI FIS Color WideL (140um), WideS (90um), N60 (65um)
AKARI FIS N160 (160um)
AKARI FIS N60 (65um)
AKARI FIS WideL (140um)
AKARI FIS WideS (90um)
CFHTLS-D-color-ugi
CFHTLS-D-g
CFHTLS-D-i
CFHTLS-D-r
CFHTLS-D-u
2MASS color J (1.23um), H (1.66um), K (2.16um)
2MASS has uniformly scanned the entire sky in three near-infrared bands to detect and characterize point sources brighter than about 1 mJy in each band, with signal-to-noise ratio (SNR) greater than 10, using a pixel size of 2.0". This has achieved an 80,000-fold improvement in sensitivity relative to earlier surveys. 2MASS used two highly-automated 1.3-m telescopes, one at Mt. Hopkins, AZ, and one at CTIO, Chile. Each telescope was equipped with a three-channel camera, each channel consisting of a 256x256 array of HgCdTe detectors, capable of observing the sky simultaneously at J (1.25 microns), H (1.65 microns), and Ks (2.17 microns). The University of Massachusetts (UMass) was responsible for the overall management of the project, and for developing the infrared cameras and on-line computing systems at both facilities. The Infrared Processing and Analysis Center (IPAC) is responsible for all data processing through the Production Pipeline, and construction and distribution of the data products. Funding is provided primarily by NASA and the NSF
properties
bib_reference 2006AJ....131.1163S
bib_reference_url http://cdsbib.u-strasbg.fr/cgi-bin/cdsbib?2006AJ....131.1163S
client_application AladinLite
client_category image/infrared/2MASS
client_sort_key 04-001-00
coordsys C
creator_did ivo://CDS/P/2MASS/color
dataproduct_subtype color
dataproduct_type image
em_max 2.403E-6
em_min 1.147E-6
format jpeg
hips_builder Aladin/HipsGen v9.017
hips_copyright CNRS/Unistra
hips_creation_date 2012-09-24T12:43Z
hips_creator CDS/A.Oberto
Terre, Strasbourg, 147 m
FOV: 0.667°
18.2 FPS
2019-04-11 23:12:56 UTC+02:00


StellariumWeb
Search...
FOV 9.08°
OBSERVE
Deneb
Evolved supergiant star
Also known as α Cyg 50 Cyg α Cyg HD 197345
HR 7924 SAO 49941 HIP 102098
Magnitude 1.25
Distance 3236.28 light years
Spectral Type A2Ia
Ra/Dec 20h 41m05.3s +45° 21' 18.4"
Az/Alt 274° 21' 26.5" +67° 21' 59.8"
Deneb (), also designated α Cygni (Latinised to Alpha Cygni, abbreviated Alpha Cyg, α Cyg), is the brightest star in the constellation of Cygnus, the swan. Deneb is one of the vertices of the asterism known as the Summer...
more on wikipedia
Deneb
Sadr
https://stellarium-web.org/
STRASBOURG
02:59:49
2020-08-12

Advanced queries : TAP



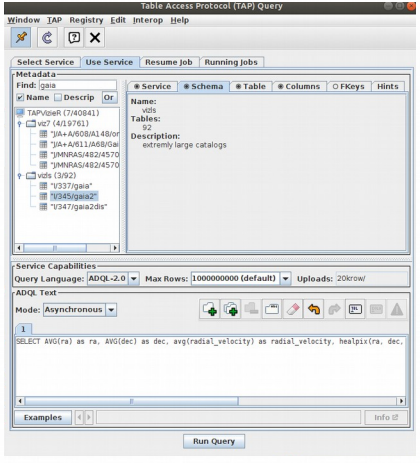
- Table Access Protocol / Astronomical Data Query Language
  - SQL-like queries for astronomical tabular data
- SDSS SkyServer demonstrated that astronomers write SQL queries - http://skyserver.sdss.org/
- Synchronous / Asynchronous queries
- SELECT … FROM table1 [JOIN table2 ON …]
  WHERE constraints
  ORDER BY …
- Support for table upload
- Used in many different archives

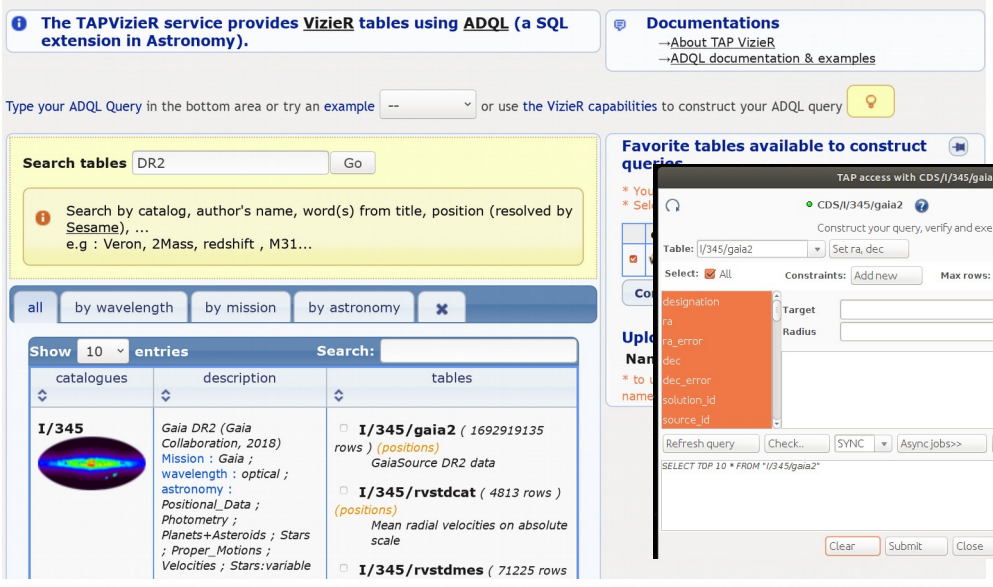
Query for Gaia sources using an ADQL (Astronomical Data Query Language) interface in an asynchronous mode (UWS).

https://gea.esac.esa.int/archive/

TAP services at CDS

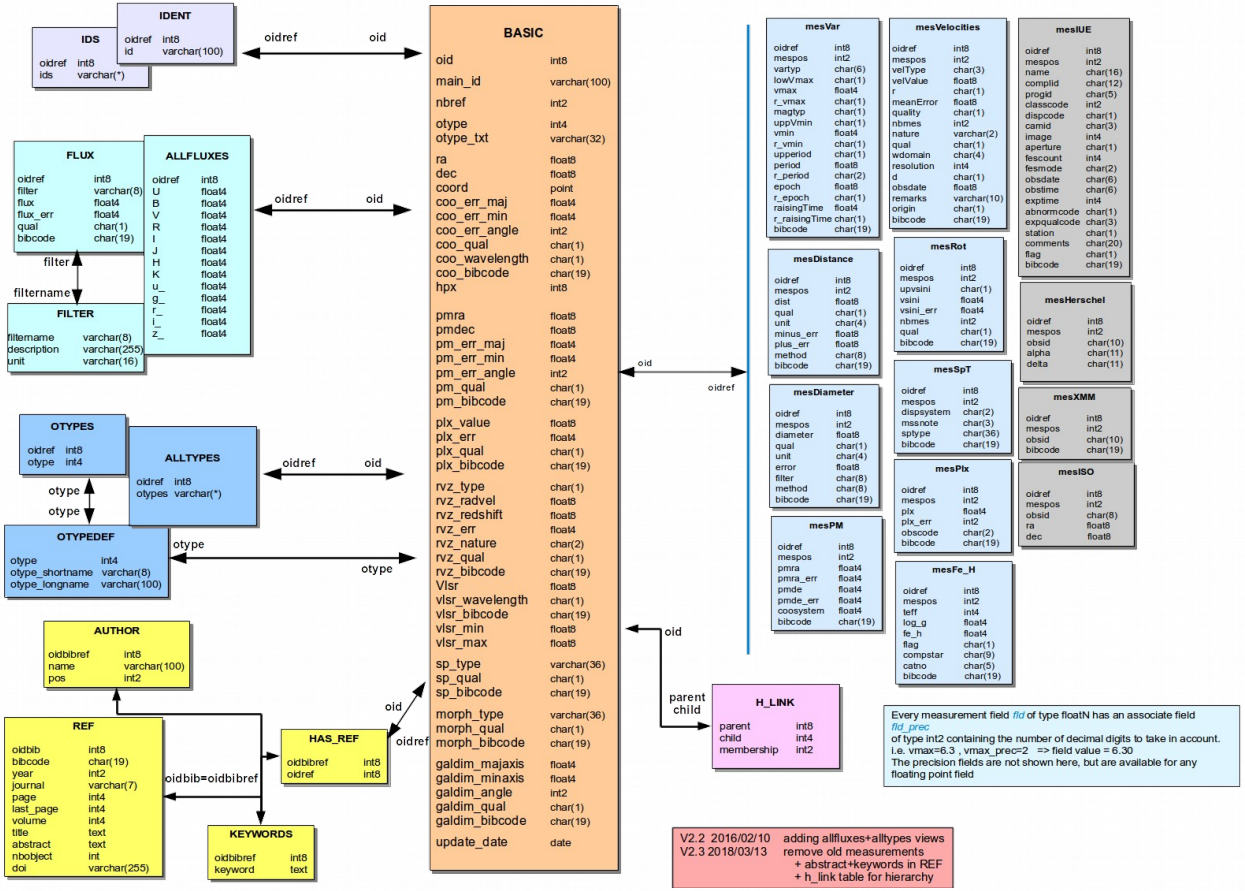
- TAP VizieR : http://tapvizier.u-strasbg.fr/
- Provides access to 40,000+ VizieR tables !
- Can be accessed from the dedicated web page, but also
  - From TOPCAT
  - From Aladin (by criteria)





TAP services at CDS

- TAP SIMBAD : http://simbad.u-strasbg.fr/simbad/sim-tap
- Measurements, identifiers, fluxes, object types, bibliography, …



Demo 2

- Reproduce the Gaia DR2 radial velocity map ?
- Visualize the rotation of the LMC ?
- Display the positions, names and V magnitudes for QSOs brighter than V=18 located within 10 degrees of the north equatorial pole
- Find the 10 most studied objects in MNRAS in 2015 ?

CDS services and Python

- Access CDS services programmatically

OCS

VizieR Queries (`astroquery.vizier`)

VizieR Queries (`astroquery.vizier`)

Getting started

This is a python interface for querying the VizieR web service. This supports querying an object as well as querying a region around the target. For region queries, the region dimensions may be specified either for a box or as a radius. Similar to the VizieR web interface, the queries may be further constrained by specifying a choice of catalogs, key-words as well as filters on individual columns before retrieving the results.

Table Discover

If you want to search for a set of tables, e.g. based on author name or other keywords, the `find_catalogs()` tool can be used:

```
>>> from astroquery.vizier import Vizier
>>> catalog_list = Vizier.find_catalogs('Kang W51')
>>> print({k:v.description for k,v in catalog_list.items()})
{'J/ApJS/191/232': 'CO survey of W51 molecular cloud (Bieging+, 2010)',
 'J/ApJ/706/83': 'Embedded YSO candidates in W51 (Kang+, 2009)'}
```

From this result, you could either get any of these as a complete catalog or query them for individual objects or regions.

Get a whole catalog

If you know the name of the catalog you wish to retrieve, e.g. from doing a `find_catalogs()` search as above, you can then grab the complete contents of those catalogs:

```
>>> catalogs = Vizier.get_catalogs(catalog_list.keys())
>>> print(catalogs)
TableList with 3 tables:
   '0:J/ApJ/706/83/ysos' with 22 column(s) and 50 row(s)
   '1:J/ApJS/191/232/table1' with 13 column(s) and 50 row(s)
   '2:J/ApJS/191/232/map' with 2 column(s) and 2 row(s)
```

ies (`astroquery.simbad`)

query the Simbad service. Presented below are examples that illustrate the different types ulated. If successful all the queries will return the results in a `Table`.

query a known identifier. For instance to query the messier object m1:

```
.simbad import Simbad
Simbad.query_object("m1")
able)
```

	DEC	RA_PREC	DEC_PREC	COO_ERR_MAJA	COO_ERR_MINA	COO_ERR_ANG
-22 00 52.2		6	6	nan	nan	0

for instance to query messier objects from 1 through 9:

```
.simbad import Simbad
Simbad.query_object("m [1-9]", wildcard=True)
able)
```

	DEC	RA_PREC	DEC_PREC	COO_ERR_MAJA	COO_ERR_MINA	COO_ERR_ANG
-22 00 52.2		6	6	nan	nan	0
00 49 23.7		6	6	100.000	100.000	0
-28 22 38.2		6	6	200.000	200.000	0
-26 31 32.7		6	6	400.000	400.000	0
-02 04 51.7		6	6	nan	nan	0
-32 15.2		4	4	nan	nan	0
-34 47.6		4	4	nan	nan	0
-24 23.2		4	4	18000.000	18000.000	179
18 30 58.5		6	6	nan	nan	0

(`astroquery.cds`)

rface for querying the CDS MOCServer.

description of arbitrary sky regions. Based on the HEALPix sky tessellation, it maps ly grouped predefined cells. It corresponds to a set of HEALPix cells at different or-

out MOCs, please refer to this IVOA paper and the MOCPy's documentation devel-

the MOCServer storing data-set names each associated with a MOC spatial cover-more detailed explanation of the data-set.

he data-sets having at least one source lying in a specific sky region defined by the orms the intersection between the given sky region and the MOCs associated with associated to a data-set describes its sky coverage, if the above intersection is not t some sources of this data-set are in the user defined sky region.

r returns, please refers to this link. We have queried the MOCServer with a cone re- deg and radius = 1.5 deg. In return, the MOCServer gives a list of data-sets each some other meta-datas too e.g. `obs_title` , `obs_description` , ssing the MOC associated with the data-set. Usually a FITS file storing a list of

Server for retrieving data-sets based on their meta-data values. Here we have queried data-sets being in the cone defined above (`dataproduct_type` meta-data

ods:

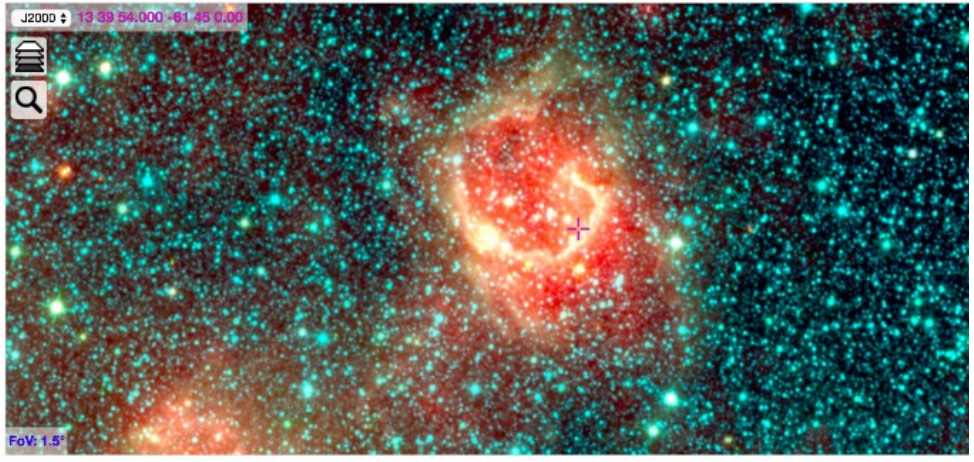
data-sets (their associated MOCs and meta-datas) having sources in a given region. data-sets (their associated MOCs and meta-datas) based on the values of their

CDS services and Python

- MOCpy
- ipyaladin

https://mocpy.readthedocs.io/en/latest/

```
In [1]: import ipyaladin.aladin_widget as ipyal

In [2]: aladin = ipyal.Aladin(target='RCW 79', fov=1.5, survey='P/allWISE/color')
        aladin
```



mocpy

Navigation

Contents:

Install
Examples
API
Contribute

Quick search

Go

Welcome to MOCPy's documentation!

Contents:

- Install
- Examples
  - Loading and plotting the MOC of SDSS
  - Intersection between GALEX and SDSS
  - Create a MOC from a concave polygon
  - Get the border(s) of a MOC
- API
  - Class overview
- Contribute
  - Setting up the environment
  - Running the tests
  - Building the documentation

MOCPy is a Python library allowing easy creation, parsing and manipulation of MOCs (Multi-Order Coverage maps). It runs under Python 2 and 3.

MOC is an IVOA standard enabling description of arbitrary sky regions. Based on the HEALPix sky tessellation, it maps regions on the sky into hierarchically grouped predefined cells.

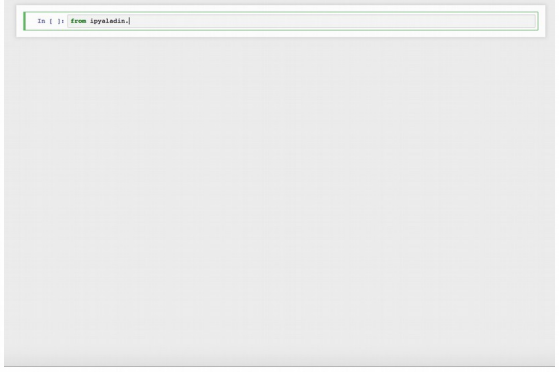
MOCPy provides the `MOC` and `TimeMOC` classes handling respectively the manipulation of spatial and temporal MOCs.

Finally, MOCPy is distributed under BSD-3 license.

Indices and tables

- Index
- Module Index
- Search Page

Example of Python usage



CDS and you

- Publish your data in VizieR : new interface

VizieR catalogue upload

The VizieR upload service is dedicated for astronomers to upload and prepare the ingestion of a new catalogue
A VizieR catalogue input consists of **tabular data** (one or more tables) and associated data like spectrum, time-series or images. These files are described in a **ReadMe** file.

This web application enables the upload of the data and invites you to fill the ReadMe file from a skeleton adapted to your catalog and which is generated by the application.

More information

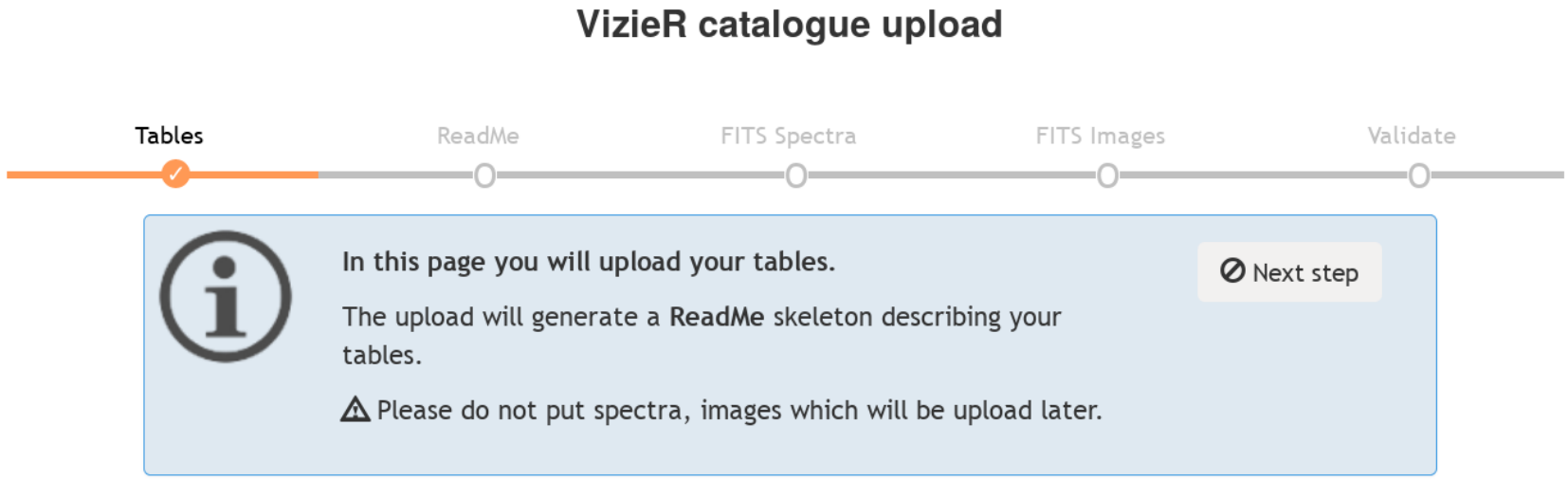
- The publications notes to have an overview of the data expected
- The submission help page

The traditional upload application remains available at: http://cdsarc.u-strasbg.fr/viz-bin/Submit.

Enter a session identifier

Identifier name, ... Begin

VizieR associated data



VizieR associated data

Search associated data among the VizieR catalogues

This web page is an access to the VizieR Associated data (images, spectra, timeseries, SED) which comes from publications. This tool is the result of the documentation assigned by the authors of the catalogues and supervised by the CDS documentalist team (see the VizieR ingestion tool).

VO compatibility

The meta-data and the search engine are built according to the VO framework (SIA, SSA, ObsTAP) and can so be queried by VO softwares. The data are gathered with the Saada engines, and the VO data model ObsCore has been choosen for the documentation.

Simple search | ObsTAP Query

Search by position : radius 1 deg

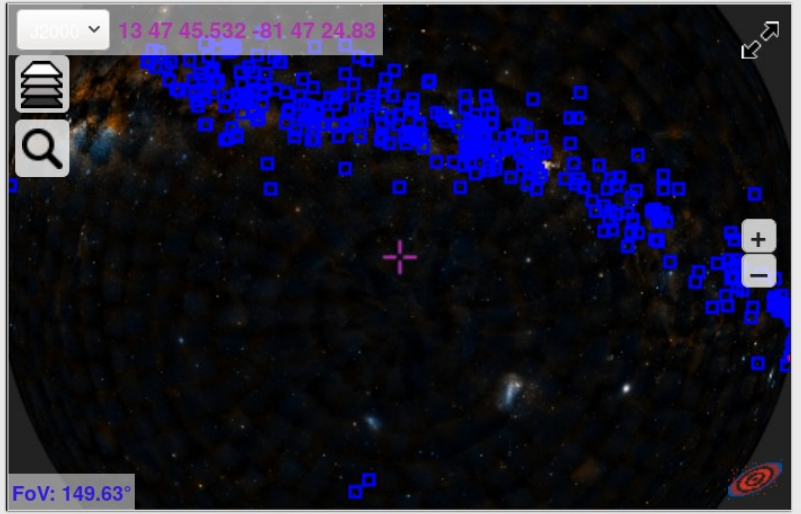
Search by spectral band : min max µm -

Search by time data : start 2015 stop 2016 (MJD)

Search by catalog: Identifier:

Spectrum / Time series Image

500 entries max Search Tar



Show 10 entries PHR0959-5703

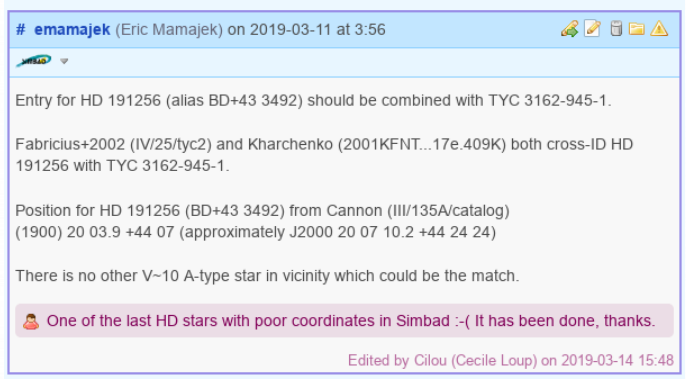
500 entries

CDS and you

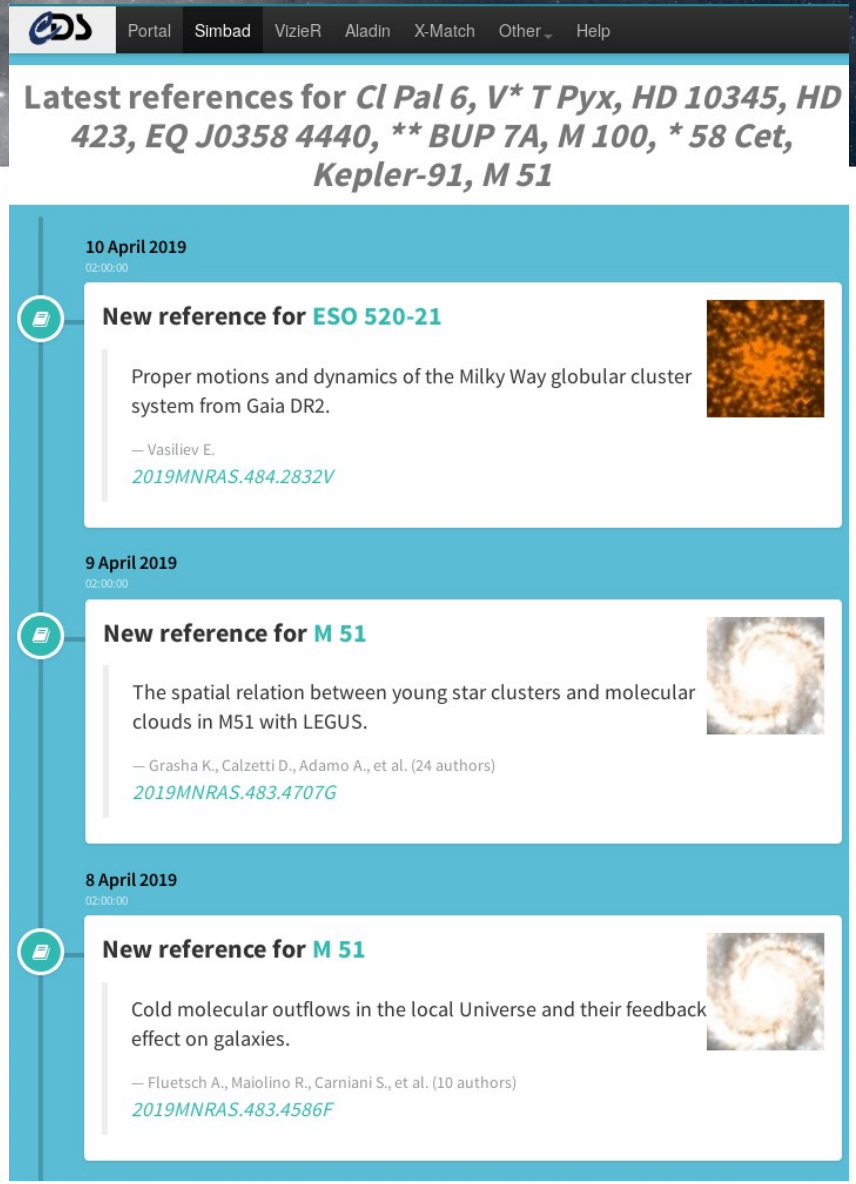
- CDS login

Login Preferences Register

  - Persistent storage space (e.g. file upload for cross-matching)
  - Write annotations on SIMBAD objects, or VizieR catalogues



  - SimWatch : http://simbad.u-strasbg.fr/tools/SimWatch/manage/

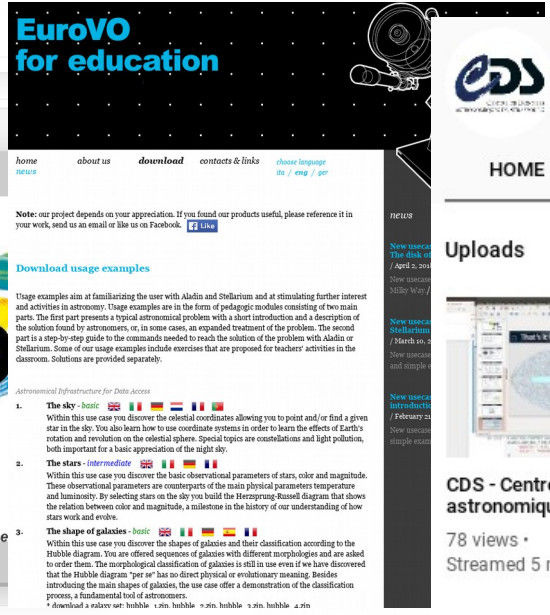


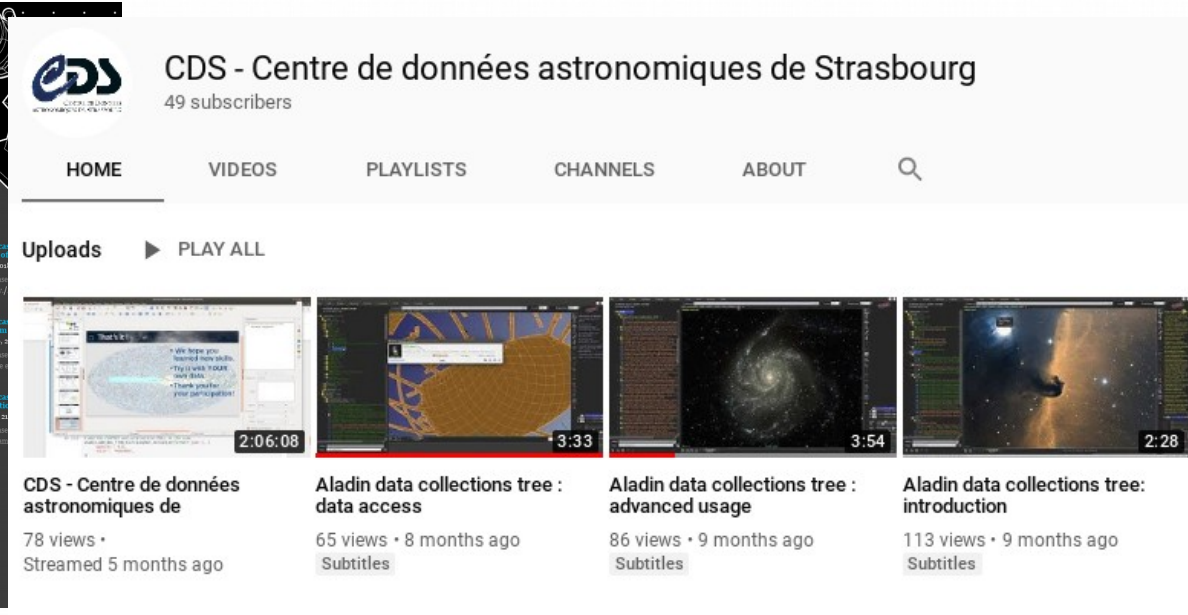
Stay tuned !

- Twitter : https://twitter.com/CdSportal
- Facebook : https://www.facebook.com/CDSportal/
- YouTube channel : https://www.youtube.com/channel/UCUESQl7rNupLlV_VcceE0Ng
- GitHub : https://github.com/cds-astro
- And of course : cds.unistra.fr cds-question@unistra.fr

CDS tutorials

- http://cds.unistra.fr/tutorials/
- http://vo-for-education.oats.inaf.it/eng_download.html
- YouTube Tutorials https://www.youtube.com/channel/UCUESQl7rNupLlV_VcceE0Ng





HiPS & MOCs ADASS 2018 tutorial

- http://cds.unistra.fr/adass2018/

All-sky astronomy with HiPS and MOCs

Tutorial 1 - ADASS XXVIII

Sunday, November 11 2018, 13:00-15:00
Instructor: Sébastien Derriere (CDS).

Introduction

The main goal of this tutorial is to teach participants how to use recent Virtual Observatory standards allowing exploration and querying of all-sky datasets. The Hierarchical Progressive Survey (HiPS) and the Multi-Order Coverage map (MOC) can be used by data providers to expose their datasets (images or catalogues), and astronomers can use them to perform complex queries on all-sky datasets. Participants will create image and catalogue HiPS, learn how to compare them to reference datasets, and share them in a web page. Advanced usage with the Table Access Protocol and astropy/MOCpy will also be shown.

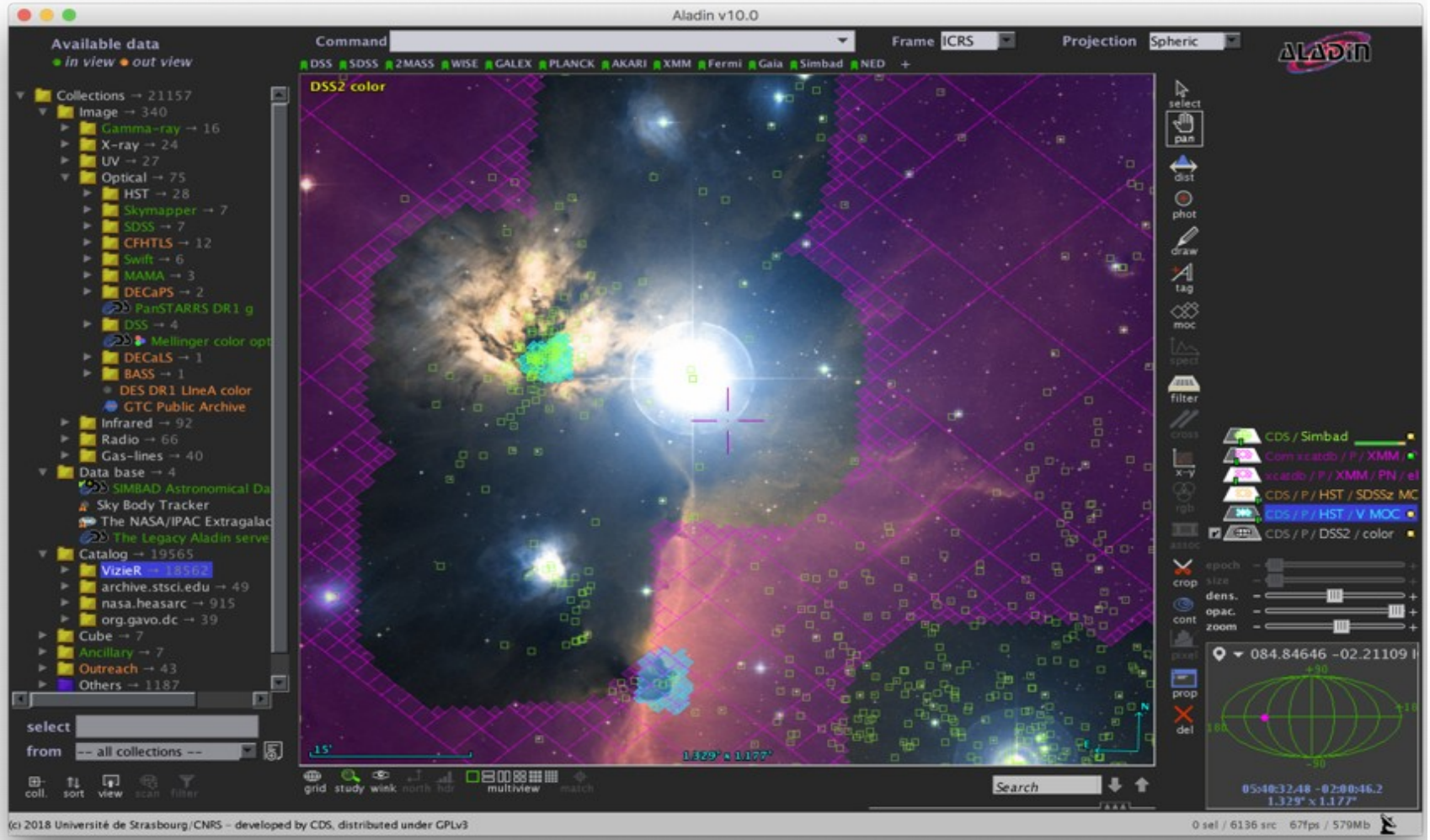
Primary learning objectives:

- How to generate HiPS and MOCs from example datasets, for both image and catalogue data.
- How to visualize all-sky datasets from the full-sky view, down to the original full resolution, and how to share and publish them (for example with Aladin lite).
- How to compare, combine and query large datasets, using CDS tools like Aladin desktop or scripts in Python.

Requirements for participants:

- Personal laptop with at least **1GB of available disk space** for data storage and processing, Wifi or network access.
- Software - you can run the tutorial with Windows, Linux or MAC, provided you have installed:
  - Web browser with JavaScript enabled.
  - Java 7 or higher, and ability to run command-line programs.
  - Aladin Desktop
  - HipsGen-Cat
  - Optionally: Python with Astroquery (astropy) package and MOCpy (for advanced use case 6.2).
- **Please download these data samples before attending the tutorial !** Test images and catalogues (~200MB total – will be available on USB sticks during the tutorial if needed):
  - https://seafile.unistra.fr/d/3713e2d5937747faa595/

Questions ?


Aladin v10.0
Available data
in view out view
Command
Frame ICRS
Projection Spheric
DSS SDSS 2MASS WISE GALEX PLANCK AKARI XMM Fermi Gaia Simbad NED
DSS2 color
Collections → 21157
Image → 340
Gamma-ray → 16
X-ray → 24
UV → 27
Optical → 75
HST → 28
Skymapper → 7
SDSS → 7
CFHTLS → 12
Swift → 6
MAMA → 3
DECaPS → 2
PanSTARRS DR1 g
DSS → 4
DECaLS → 1
BASS → 1
DES DR1 LineA color
GTC Public Archive
Infrared → 92
Radio → 66
Gas-lines → 40
Data base → 4
SIMBAD Astronomical Da
Sky Body Tracker
The NASA/IPAC Extragalac
The Legacy Aladin serve
Catalog → 19565
VizieR → 18562
archive.stsci.edu → 49
nasa.heasarc → 915
org.gavo.dc → 39
Cube → 7
Ancillary → 7
Outreach → 43
Others → 1187
select
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CDS / P / HST / V MOC
CDS / P / DSS2 / color
epoch
size
dens.
opac.
zoom
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05:40:32.48 -02:00:46.2
1.329' x 1.177'
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