Open software for astrophysics

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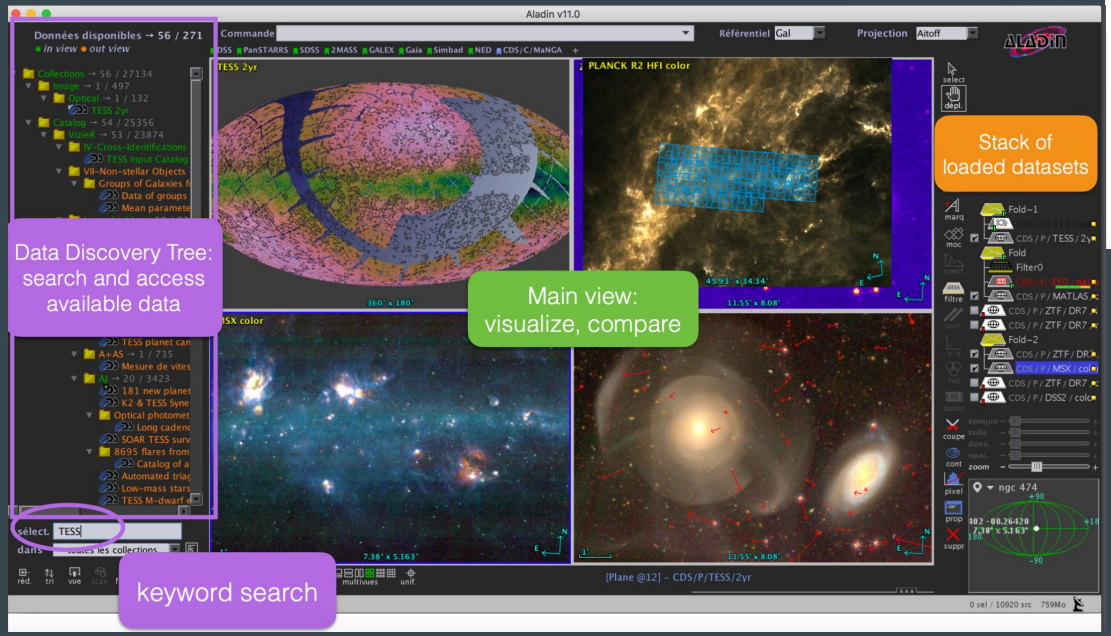
CENTRE DE DONNÉES
ASTRONOMIQUES DE STRASBOURG

CDS work through the Aladin Project

- Started at the beginning of 90's
- Desktop complete version (java client)



Aladin Desktop version

ALADIN: AN INTERACTIVE DEEP SKY MAPPING FACILITY

1994IAUS..161..347P

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France

2. Aladin Project

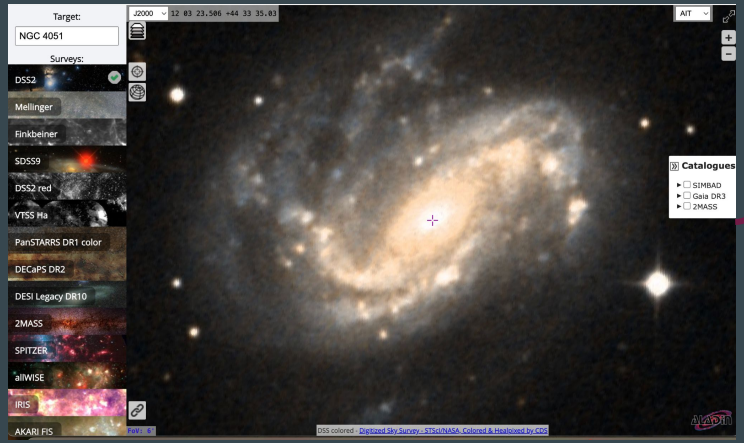
CDS began the Aladin project in 1992. The CDS council agreed with the general idea in September 1992. In December 1992, the Astronomy group of INSU/CNRS decided that a priority was the funding needed to start this CDS project. Funding for Aladin's construction was approved in June 1993, after a project review. Aladin will provide access, in addition to a complete sky atlas, to up-to-date data contained in Simbad and catalogue archives. Distribution of this tool to some selected sites is foreseen for the end of 1995.

For the interactive sky atlas, requirements in storage capacity are of the order of one Tbyte for complete sky coverage (1 TB for a complete sky in one colour with a resolution of 1 arcsec and coding on 16 bits; this can be reduced by using data compression). Hardware and software solutions for one Tbyte data archiving exist and are already in use. These solutions rely on 12" WORM optical disks systems and are now used in several places (ESA/ESRIN, STScI, NASA). The access speed to stored information is compatible with the proposed application (less than one minute to access a given sky region image). New technology to archive several tens of Tbytes

First paper mentioning the Aladin visualizer project (1994)

Aladin Lite web client

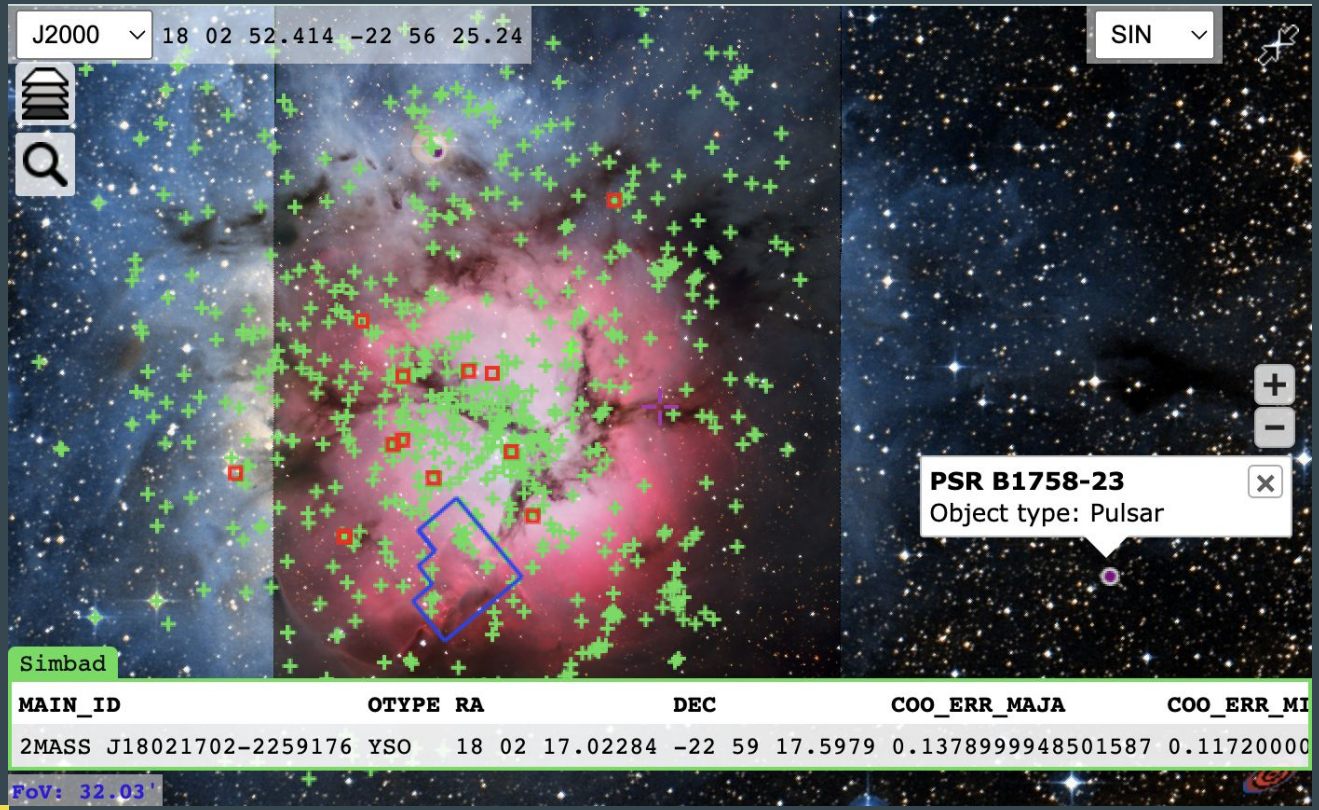
https://aladin.cds.unistra.fr/AladinLite/ODW/open-data-week.html



Access to the Aladin Lite portal

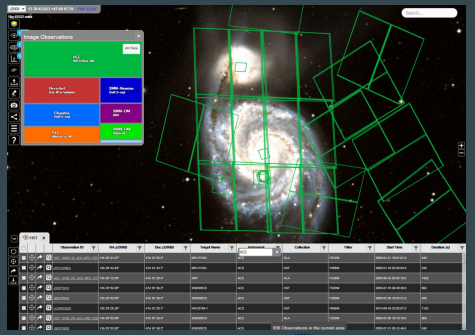
Aladin Lite

- Javascript web client
- GPLv3 licensed (*might change in the future…*)
- Multi-resolution image viewer
  - The more you zoom the more you see
  - WebGL2 canvas rendering
- Lightweight: 500kB
- Easy to embed in a webpage
  - No plugins installation required
  - Javascript API to interact with the Aladin view



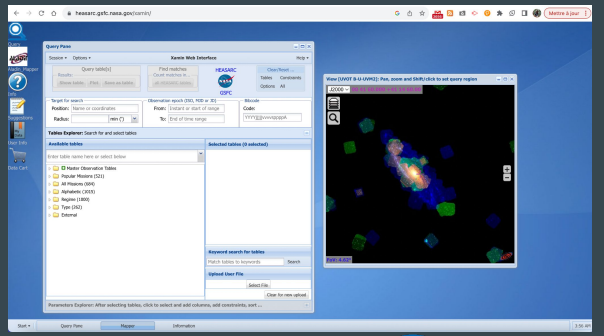
Users of Aladin Lite

NASA, ESA, ESO, …

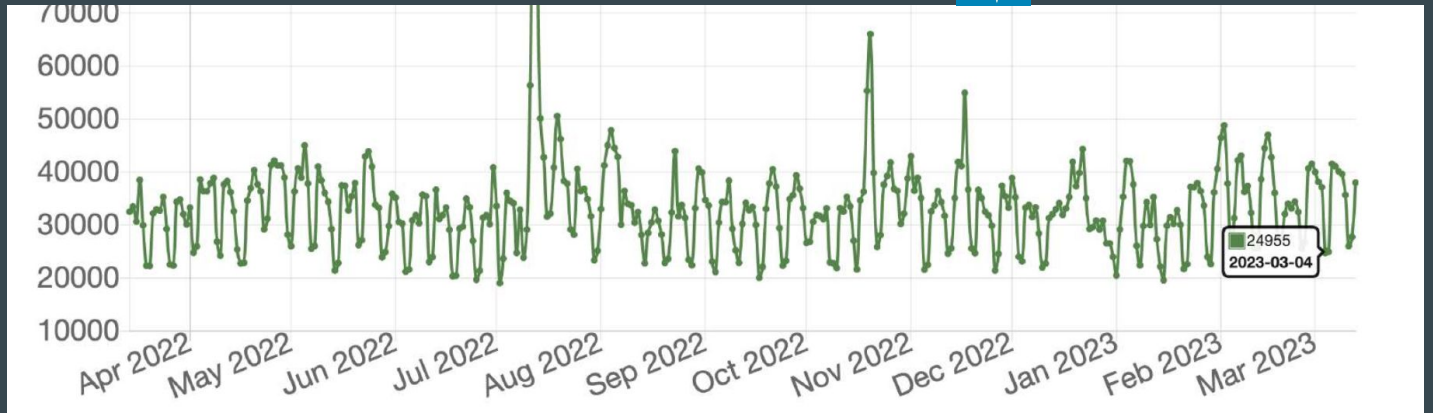


ESASky 5.x

ESO
Science Portal



NASA HEASARC



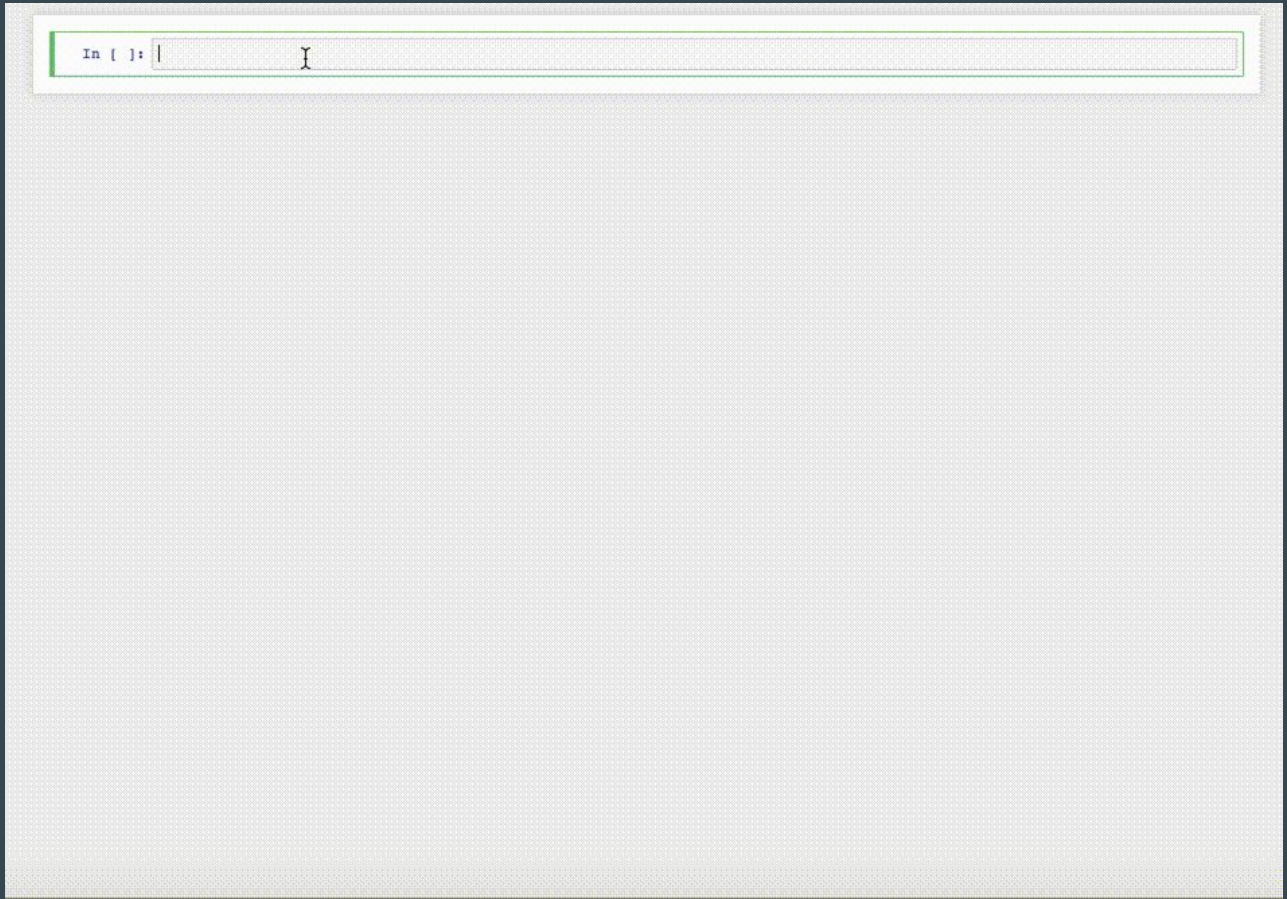
30/40 thousands startups a day

Open source developments of Aladin Lite

- Source code hosted on GitHub: https://github.com/cds-astro/aladin-lite
- 7 contributors: 3 internals/4 externals (e.g. our ESO partner)
- Many discussions with our users (~40 PR, ~50 issues)
- GPLv3 licensed
- CI (GitHub Actions) for testing and deploying NPM package of Aladin Lite
- Javascript API Documentation, examples and tutorials hosted here: https://aladin.cds.unistra.fr/AladinLite/doc/

ipyaladin : A python API of Aladin Lite

https://github.com/cds-astro/ipyaladin



Demonstration Time!

cds-astro.github.io/jupyterlite/

1. Open software for astrophysics

Specific needs:
- data preparation
- visualization
- analysis

Strasbourg Astronomical Data Center ~ 30 software available on a forge

https://github.com/cds-astro

- offer support for formats specific to astronomy,
- allow access to the data hosted in CDS,
- sky-region manipulations,

2. File & data formats (parsers, I/O)

wcs-r & fitsrs

FITS: image and table format. WCS: links pixels to positions in the sky.

- API
- contributors
  - 1 inside
  - 1 outside
- APACHE-2 & MIT

cds-votable

VO-table: tabular data with integrated metadata

- API
- contributors
  - 1 inside
  - 0 outside
- APACHE-2 & MIT

cds-pyreadme

A tool for authors submitting data to CDS

- API
- contributors
  - 2 inside
  - 0 outside
- BSD-2

- python implementation in astropy
- these are faster

- meant for authors publishing to CDS only

3. Data retrieval (queries)

bstree-file

Binary Search Tree:
retrieve data from
files larger than RAM

- API
- contributors
  - 1 inside
  - 0 outside
- APACHE-2 & MIT

powers the CDS public API
(POST requests)

Community libraries

AstroLIB (IDL)

Stellarium (GUI)

GNUAstro (C/CLI)

TOPcat (GUI)

FV (C/CLI)

astroquery (python)

3 inside collaborators

4. Manipulation of space/time/frequency information

cds-healpix

A way of defining pixels on the sky

- API
- contributors
  - 5 inside
  - 3 outside
- APACHE-2 & MIT

cds-MOC

Group of space/time/ frequency pixels of disparate sizes

- API
- contributors
  - 4 inside
  - 6 outside
- APACHE-2 & MIT

cds-STC

Exact representation of space/time/frequency coordinates

- API
- contributors
  - 1 inside
  - 0 outside
- APACHE-2 & MIT

optimized for queries

for precise regions

efficient method:
core app in Rust,
wrappers to provide
multiple APIs

Conclusion

- lots of bricks to connect a graphical user interface to a database
- open from dev tools to end-user software

- MIT, Apache-2, BSD-3
- less contributors

- GPL-3
- more contributors

please ask lots of questions!

Backups