

Centre de Données astronomiques de Strasbourg (CDS)

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EAS conference: CDS Lunch Session (LS4)

July 02, 2020

 @

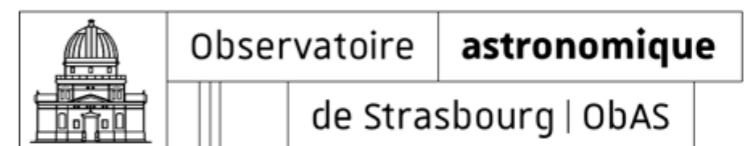
 Leiden
2020
Virtual



CDS - a Research Infrastructure under joint authority of UNISTRA and CNRS-INSU



hosted by



□ CDS - Astronomy Data Centre

An integrated team of :

SCIENTISTS **Engineers** **Documentalists**



CDS - a data centre for astronomy *reference* data... since 1972

Our mission:

- Collect useful data on objects in electronic form
- Improve them by critical evaluation and combination
- Distribute the results to the international community
- Conduct research using the data

Science Driven:

- ***Necessary evolutions** to meet the scientific reference service needs of the astronomy community*

CDS reference services for the astronomy research community



Reference Database of Astronomical Objects :
~11 million objects, ~36 million ID, 22 million citation links



Reference service of astronomical catalogues :
19169 Catalogues, 40000+ published tables, ~28 billion rows



Visualisation and image database :
825 HiPS surveys: images (~320 TB)

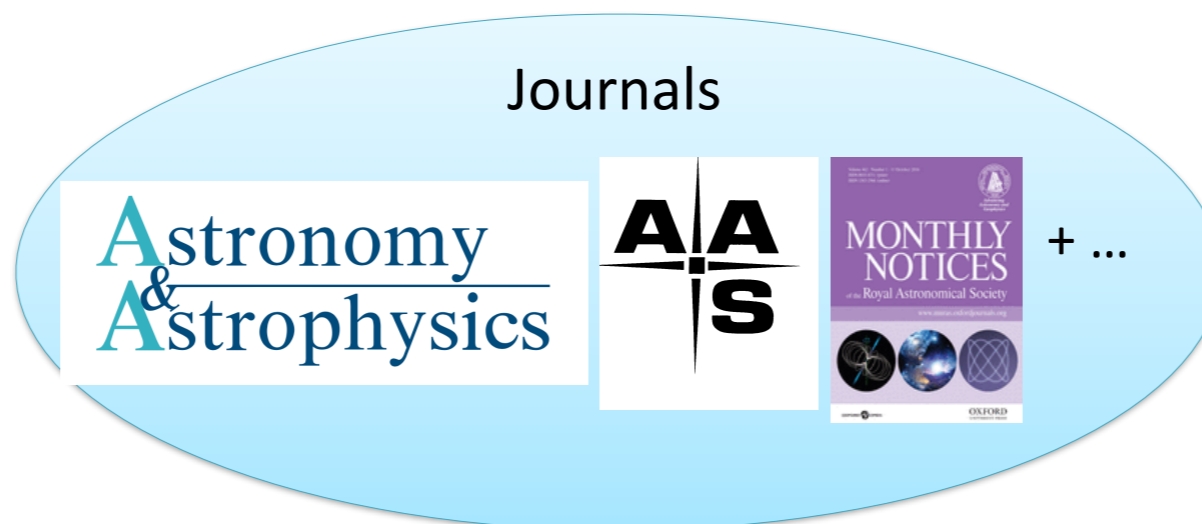
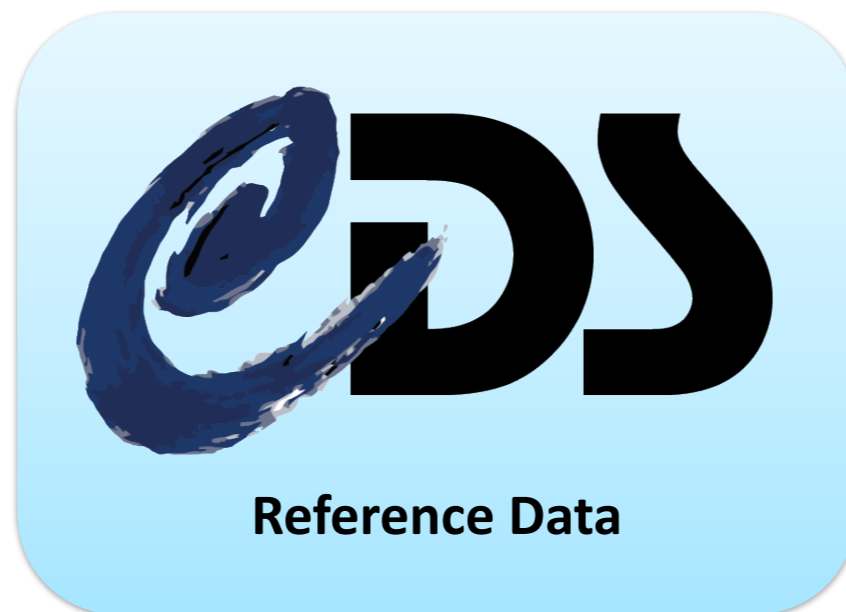
+ Cross-match service, CDS Portal, and many APIs...



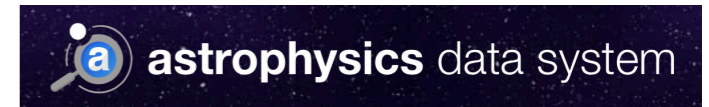
CDS – a part of the global astronomy infrastructure



Ground and Space
Observatories, Instruments and
missions



Astronomy Data Centres



Virtual Observatory



Data e-Infrastructures



□ Open Science

F
Findable



A
Accessible



I
Interoperable



R
Reusable



□ An example using

NGC 4039 - an interacting galaxy

- Find the data available
 - Access the data
 - Interoperable use of the data with other data
 - Re-use the data

Findable

Aladin v10.0

Command **NGC 4039**

DSS SDSS 2MASS WISE GALEX PLANCK AKARI XMM Fermi Gaia Simbad NED

select
from -- all collections --

exp. sort view scan filter

grid study wink north hdr multiview match

Aladin is developed by Pierre Fernique,
Thomas Boch, Anaïs Oberto, François Bonnarel and Chaitra.
(c) 2018 Université de Strasbourg/CNRS - developed by CDS, distributed under GPLv3

assoc
crop
cont
epoch
pixel size
dens.
prop opac.
zoom
del

0 sel / 0 src 0Mb



Aladin v10.0

Available data → 23753 / 23756
● in view ● out view

Command [] Frame ICRS Projection Spheric

DSS SDSS 2MASS WISE GALEX PLANCK AKARI XMM Fermi Gaia Simbad NED +

DSS2 color

Found ! - data available

No data here

select
pan
dist
phot
draw
tag
moc
spect
filter
cross
x-y
rgb
assoc
crop
cont
epoch
pixel size
dens.
prop opac.
zoom
del

Welcome to Aladin,
your professional sky atlas.

- Discover all astronomical data available over the net!
- Compare them with your own data.
- Prepare your observation missions.

To start, type any object name, such as M1, and press ENTER...

Or easier, clic in the main frame and enjoy the sky...

CDS / P / DSS2 / color

epoch
pixel size
dens.
prop opac.
zoom

NGC 4039

12:01:52.79 -18:52:51.6
57'24" x 46'2"

coll. sort view scan filter
grid study wink north hdr multiview match

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0 sel / 0 src 77fps / 275Mb



□...based on standardised coverage map indexing

The screenshot displays the Aladin v10.0 interface. At the top, it shows 'Available data → 23753 / 23756', 'Command', 'Frame ICRS', and 'Projection Spheric'. A toolbar at the top lists various astronomical surveys: DSS, SDSS, 2MASS, WISE, GALEX, PLANCK, AKARI, XMM, Fermi, Gaia, Simbad, and NED. The main window features a 3D spherical sky map with a grid overlay. The map is primarily orange, with blue regions indicating data coverage for 'SDSS9 color'. A red crosshair is visible on the map. On the left, a 'Data discovery tree' lists various astronomical datasets, including HST, Skymapper, SDSS, CFHTLS, Swift, MAMA, DECaPS, DES, PanSTARRS, DSS, DECaLS, IPHAS, BASS, GTC Public Archive, Infrared, VISTA, UltraVista, 2MASS, DIRBE, UKIRT-WFCAM, and WISE. The 'SDSS9 color' dataset is selected. On the right, a 'Data discovery tree' panel provides instructions on how to browse, filter, and select data collections. Below this panel, a list of data collections is shown, with 'CDS / P / SDSS9 / color' selected. At the bottom right, a small inset map shows the current view's location on the sky, with coordinates 180.46994 -18.88100 ICRS and a zoomed-in view of the data points. The bottom status bar shows '0 sel / 0 src 91fps / 465Mb'.

Accessible

Aladin v10.0

Available data → 23753 / 23756
● in view ● out view

Command [] Frame ICRS Projection Spheric

PanSTARRS DR1 color-z-zg-g

7.205' x 5.214'

12:01:52.77 -18:52:51.4
7.205' x 5.214'

0 sel / 0 src 107fps / 461Mb

(c) 2018 Université de Strasbourg/CNRS – developed by CDS, distributed under GPLv3

Download in science/visualisation formats



Interoperable

Aladin v10.0

Available data → 23753 / 23756
 ● in view ● out view

Command [] Frame ICRS Projection Spheric

DSS SDSS 2MASS WISE GALEX PLANCK AKARI XMM Fermi Gaia Simbad NED +

Fake color X-ray images (Red=0.5-1keV) Green=1-2keV
 X-ray images on band 0.5-1keV
 ASCA → 2
 MAXI → 2
 Hitomi SXI public data image
 Hitomi SXS public data image
 Suzaku public data image
 CXC → 1
 ROSAT X-Ray All-Sky Survey
 → 27
 ROSATWFC → 3
 GALEX → 3
 GALEX GR6 AIS (until March 2014)- Far UV
 GALEX GR6 AIS (until March 2014)- Color compo
 GALEX GR6 AIS (until March 2014)- NEAR UV
 Swift → 15
 HST → 6
 ical → 91
 HST → 28
 PHAT → 6
 GOODS → 5
 HLA → 8
 HST-B includes the following filters: F450W, F439W
 HST-SDSSg includes the following filters: F475W
 HST-V includes the following filters: F555W, F547W
 HST-SDSSr includes the following filters: F625W and
 HST-R includes the following filters: F702W and F6
 HST-wideV includes the following filters: F606W an
 HST-I includes the following filters: F814W, F791W,
 HST-SDSSz includes the following filters: F850LP
 HST-Others includes the ALL the other filters not us
 Skymapper → 7
 SDSS → 7
 SDSS9 band u
 SDSS9 band g
 SDSS9 color (g, r, i CDS color composition)
 SDSS9 color
 SDSS9 band r
 SDSS9 band i
 SDSS9 band z
 CFHTLS → 12
 Swift → 6

select []
 from -- all collections --

CDS / P / HST / B
 CDS / P / HST / I
 JAXA / P / SUZAKU
 xcatdb / P / XMM / PN / col
 JAXA / P / SWIFT_BAT_FLU
 CDS / P / GALEXGR6 / AIS
 CDS / P / IRIS / color
 CDS / P / HST / SDSSr
 CDS / P / DSS2 / color~1
 CDS / P / 2MASS / color
 CDS / P / allWISE / color
 CDS / P / SDSS9 / color
 CDS / P / PanSTARRS / DR1
 CDS / P / PanSTARRS / DR0
 CDS / P / PanSTARRS / DR0
 CDS / P / PanSTARRS / DR0
 CDS / P / PanSTARRS / DR0
 CDS / P / SDSS9 / u
 CDS / P / SDSS9 / color-a
 CDS / P / HST / wideV
 CDS / P / HST / I MOC
 xcatdb / P / XMM / PN / col
 CDS / P / HST / SDSSr MOC
 CDS / P / SDSS9 / color MO
 CDS / P / PanSTARRS / DR1
 CDS / P / DSS2 / color

epoch []
 pixel size []
 dens. []
 prop opac. []
 zoom []
 del []

180.46138 -18.88187 IC
 12:01:54.41 -18:52:45.2
 4.971' x 3.595'

[View A1] - CDS/P/PanSTARRS/DR1/color-z-zg-g~1
 0 sel / 0 src 508fps / 753Mb

Reusable

Services for extracting :cut-outs of the data for re-use

hips2fits

Fast generation of FITS cutouts from HiPS datasets

The hips2fits service enables generation of FITS images cutouts of arbitrary size and resolution from a given HiPS.

Try it now!

Use the form above to test the service

By parameters | **By WCS**

HiPS survey

Dimension x pixels

Target

Projection

Image size degrees

Projection frame ICRS Galactic

Rotation angle degrees

Download FITS

Preview JPG

Open JPG in new tab

jupyter hips2fits (unsaved changes)

File Edit View Insert Cell Kernel Widgets Help

Code

```
i = 0
for obj in objects:
    for hips in hips_list:
        axs[i].set_axis_off()

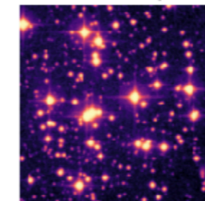
        axs[i].set_title('{} - {}'.format(obj, hips))
        sc = SkyCoord.from_name(obj)
        ra = sc.icrs.ra.deg
        dec = sc.icrs.dec.deg
        url = 'http://alasky.u-strasbg.fr/hips-image-services/hips2fits?hips={}&width={}'

        hdu = fits.open(url)

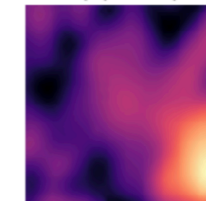
        hdu.writeto('{}-{}.fits'.format(obj, hips.replace('/', '_')), overwrite=True)
        im = hdu[0].data
        norm = ImageNormalize(im, interval=MinMaxInterval(),
                               stretch=AsinhStretch())
        axs[i].imshow(im, cmap='magma', norm=norm, origin='lower')

        i += 1
```

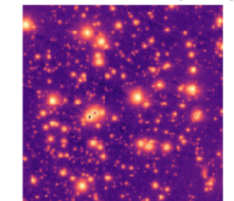
M36 - DSS2/red



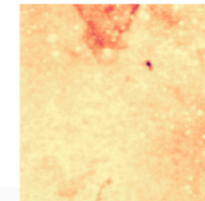
M36 - CDS/P/AKARI/FIS/N160



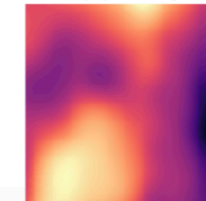
M36 - PanSTARRS/DR1/z



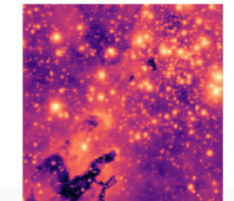
M16 - DSS2/red



M16 - CDS/P/AKARI/FIS/N160



M16 - PanSTARRS/DR1/z



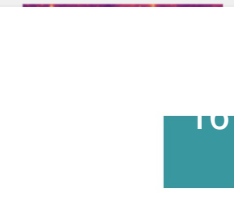
M20 - DSS2/red



M20 - CDS/P/AKARI/FIS/N160



M20 - PanSTARRS/DR1/z



□ Common language...

FAIR

- **F**indable, **A**ccessible, **I**nteroperable, **R**eusable

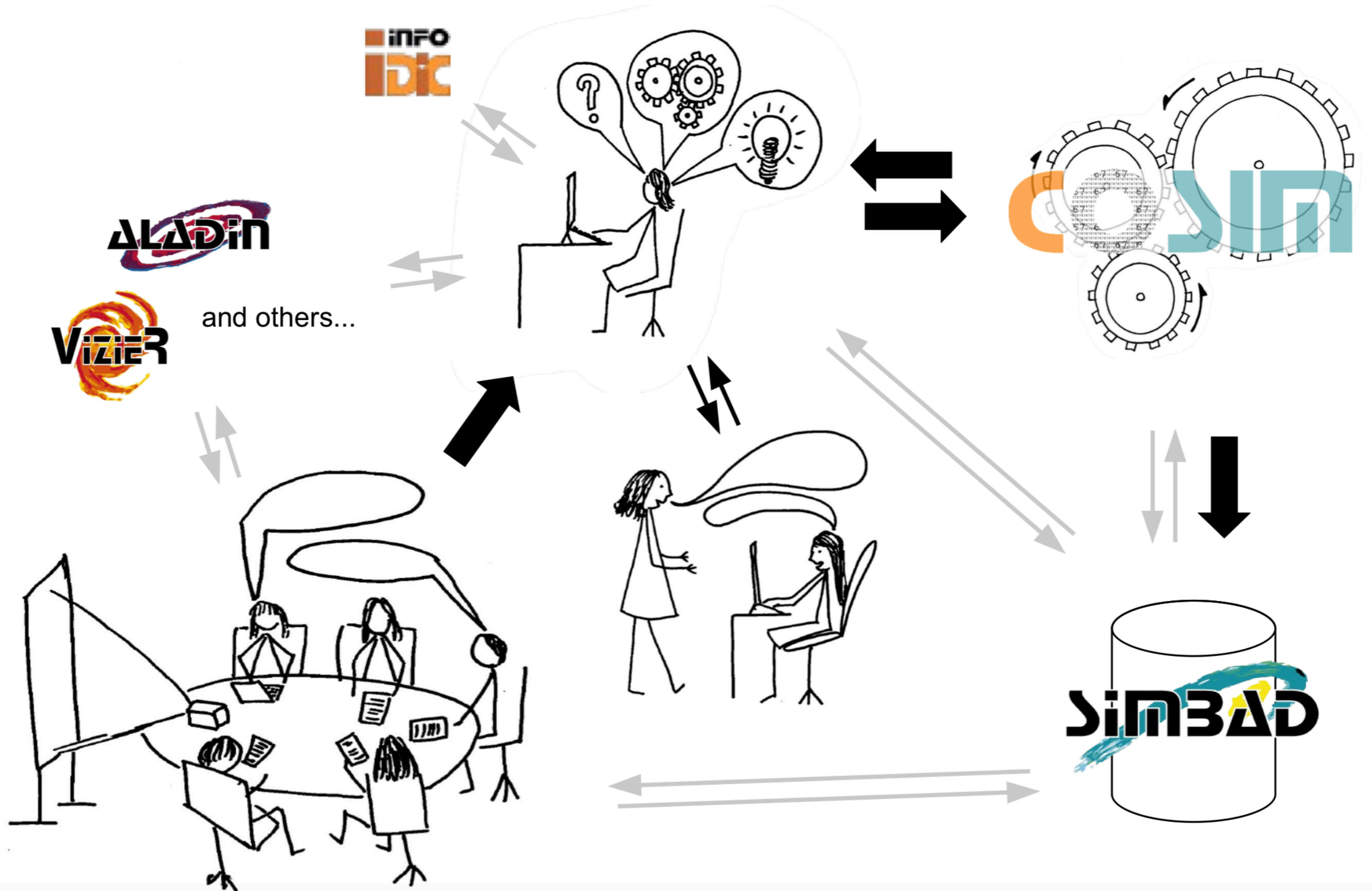
Open Science

- Data sharing with open and seamless services to analyse and reuse research data to improve science


Stewardship

- Human skills for curation, quality content, data management, services

□ Enabled by integrated team



□ Certification of CDS

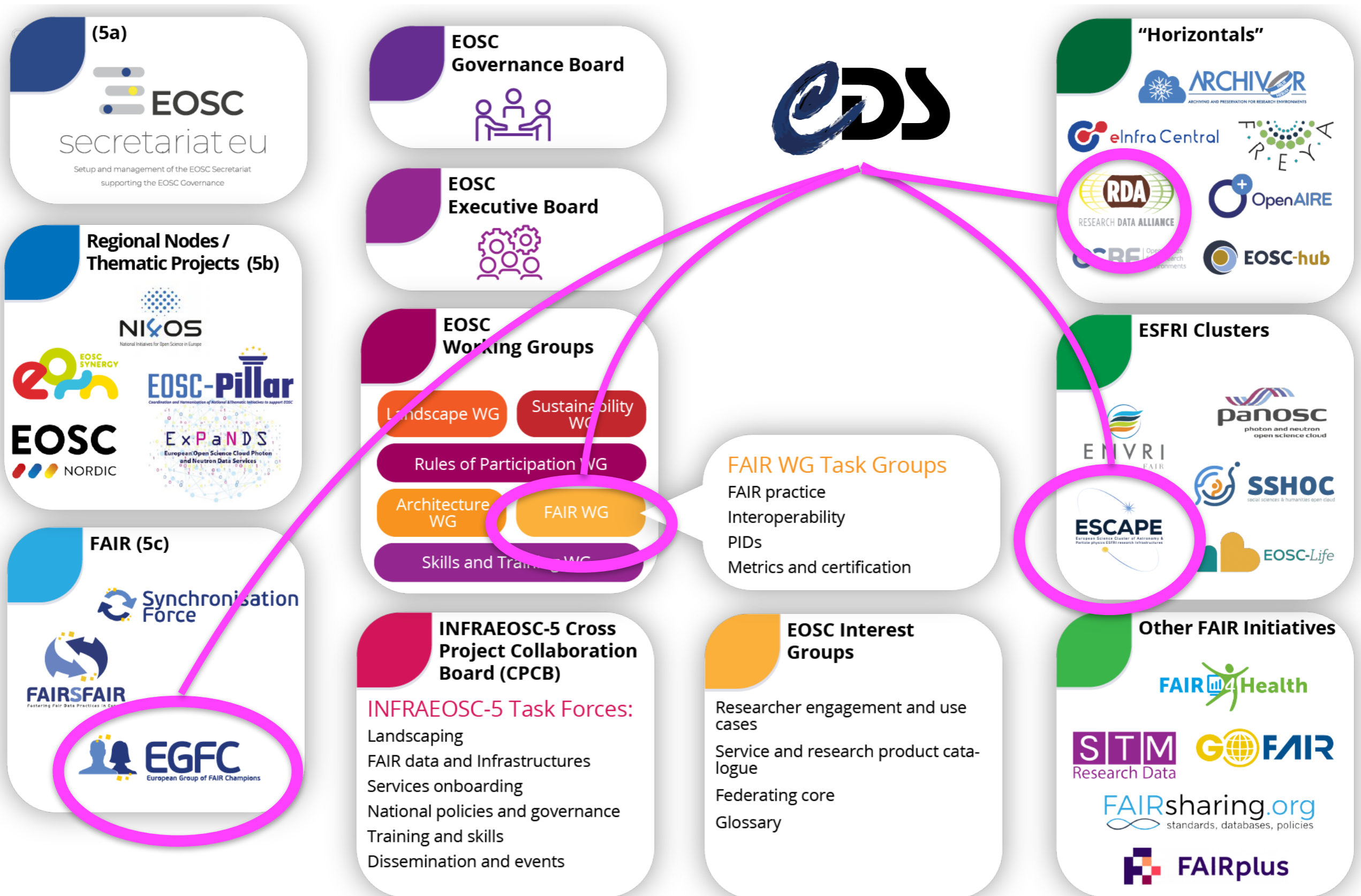
- The CDS is certified as a ***Trustworthy Data Repository*** by the CoreTrustSeal (<https://www.coretrustseal.org>)
- Relevant to Data Management Plans (DMP) increasingly required for data collected with public funds
- Publishing your data in  means it is in a certified repository



- Merged certification organisations



Wider context of data sharing in Europe: Infographic from the FAIRsFAIR project



Users

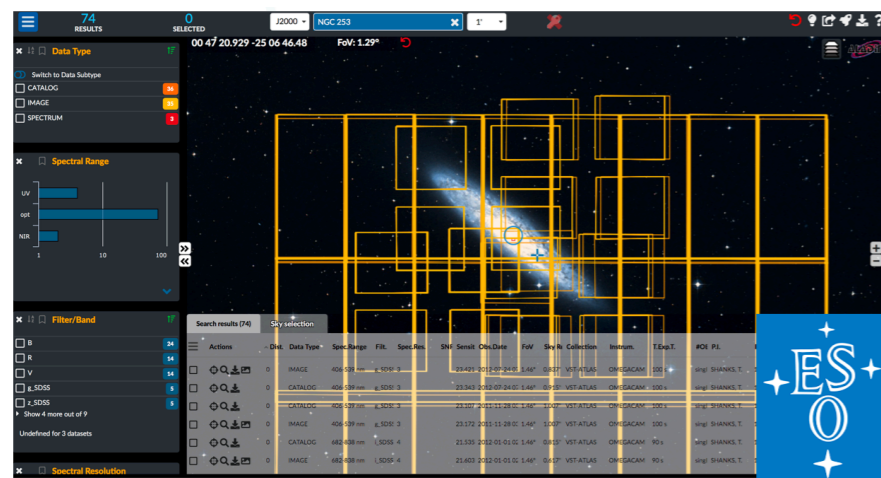
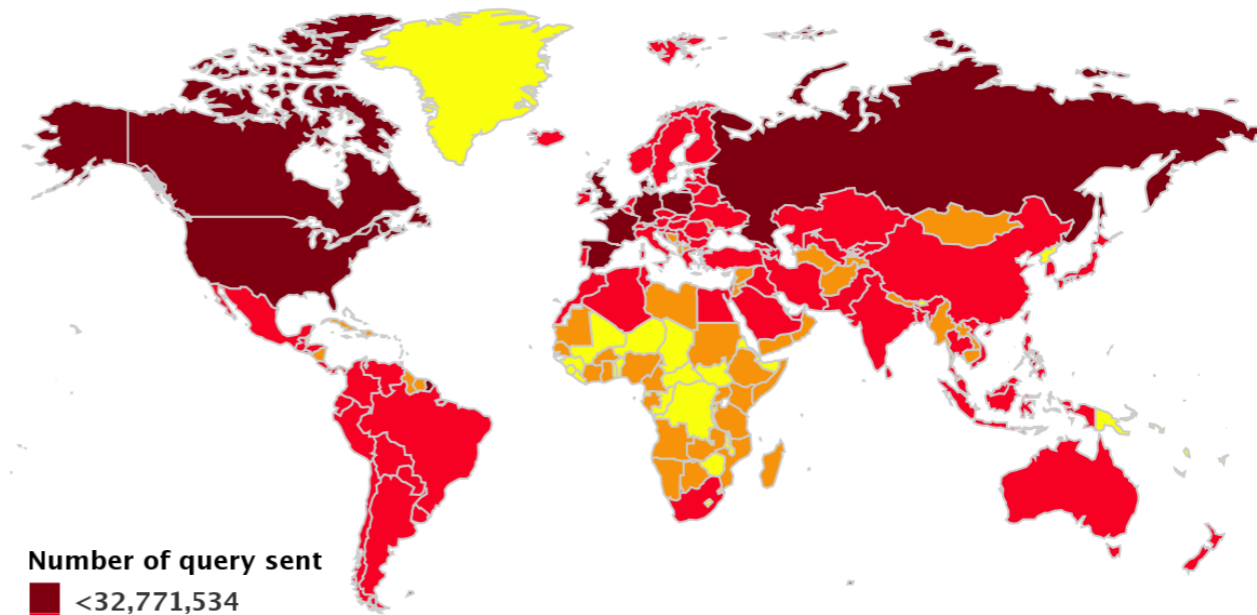
> 1.7 M queries/day

Astronomy researchers - global

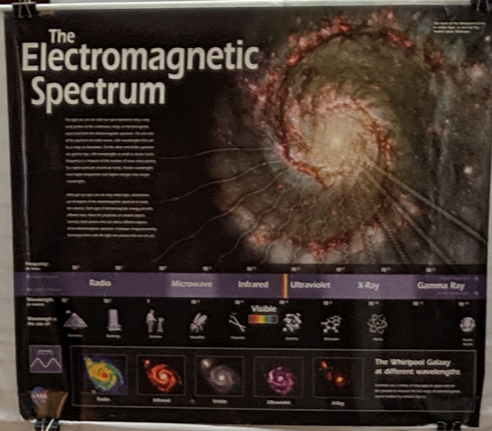
Observatories / Space agencies
and Astronomy Data Centres

- CDS components integrated into their systems

Education and outreach users -
public dissemination of science



STELLAR EVOLUTION: A JOURNEY WITH CHANDRA

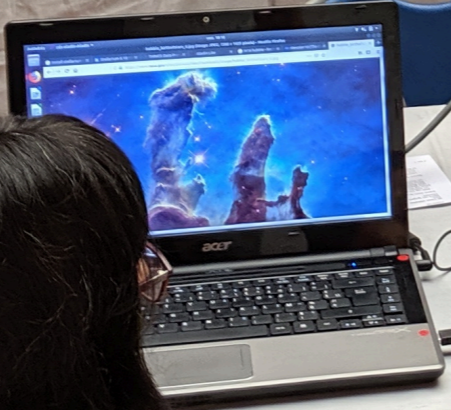
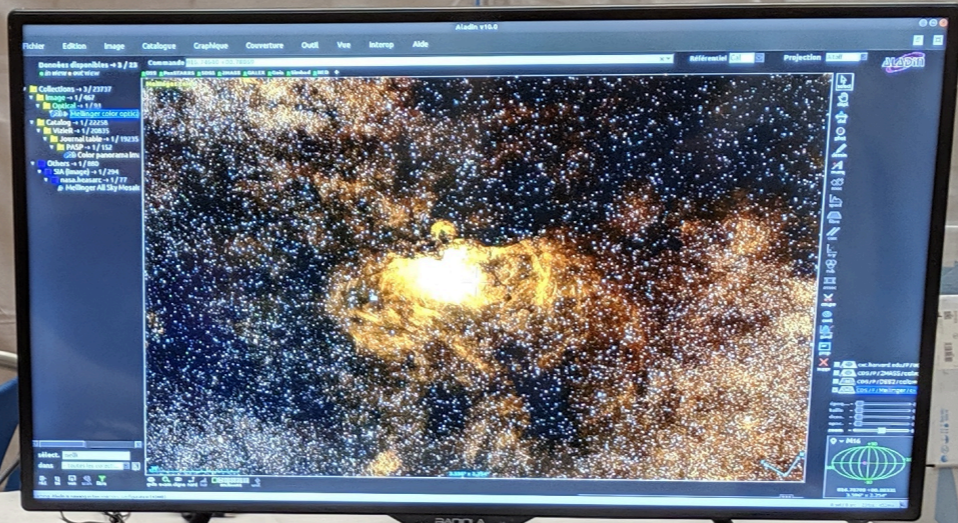


Le Moyen âge arabe : un âge d'or p...

Sources ?

Extrait d'une pharmacopée (el-Kindi)

Chimistes



□ *Help CDS to help you!*

Today's Lunch session

Presentations about some of the CDS services

- SIMBAD
- VizieR
- CDS in python notebooks

Emphasis on how to get your data well ingested into CDS

- *Good practices, understanding the process*

Feedback - let us know how we can help you !

<http://cds.unistra.fr>