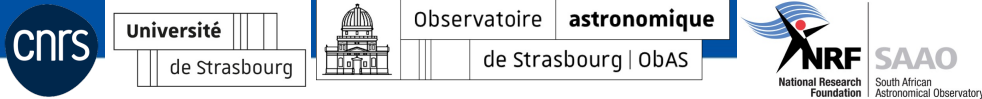


Report on the *Virtual Observatory Tools for Students and Educators* workshop

M. Allen, M. Baumann, B. Berriman, P. Hasan, M. Marchand, P. Sharma, P. Whitelock.



IVOA Interop meeting
4 June 2025



One day IAU general assembly satellite workshop

Virtual Observatory Tools for Students and Educators in Africa

14 August 2024

We will emphasize an 'all sky' approach, and combination of data from different telescopes and archives.

10h30: Introduction to the Virtual Observatory and CDS services
web pages and desktop applications



13h30: Programmatic Access to VO services and data using Python
diving in automatization



astropy, astroquery, PyVO, mocpy, ipyaladin



15h30: Stars and Exoplanets: Gaia, Kepler, TESS
case studies on popular archives



17h15: Hands on. Support of Participants personal projects
*informal time to help integrate VO tools in
participants own research or teaching projects*

Tutors:

Mark Allen (CDS)

Matthieu Baumann (CDS)

Priya Hasan (Maulana Azad National Urdu
University)

Manon Marchand (CDS)

Pooja Sharma (CDS)

Extra training materials:

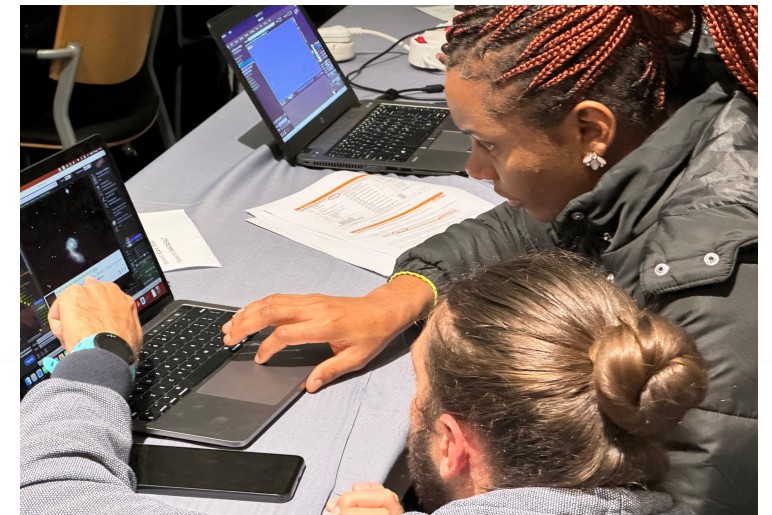
Bruce Berriman (IPAC/Caltech)

With the support of:

Patricia Whitelock (SAAO & UCT)

Kevin Govender (IAU OAD)

Charles Takalana (AfAS)





A side-event of the IAU GA

- Enabled by local organisers.
- ***In-person*** only – to favour interaction.
- Hosted in the conference venue.
- Participants needed to already be registered for the GA.

- Participants needed to bring their own laptops
- Logistics, A/V equipment, room set-up : generously organized by SAAO, IAU



Participants

- The event was advertised in Africa.
- 32 participants (selected from 90 applications).
- - *some +/- on the actual day...*

- 15 countries

- Profiles:

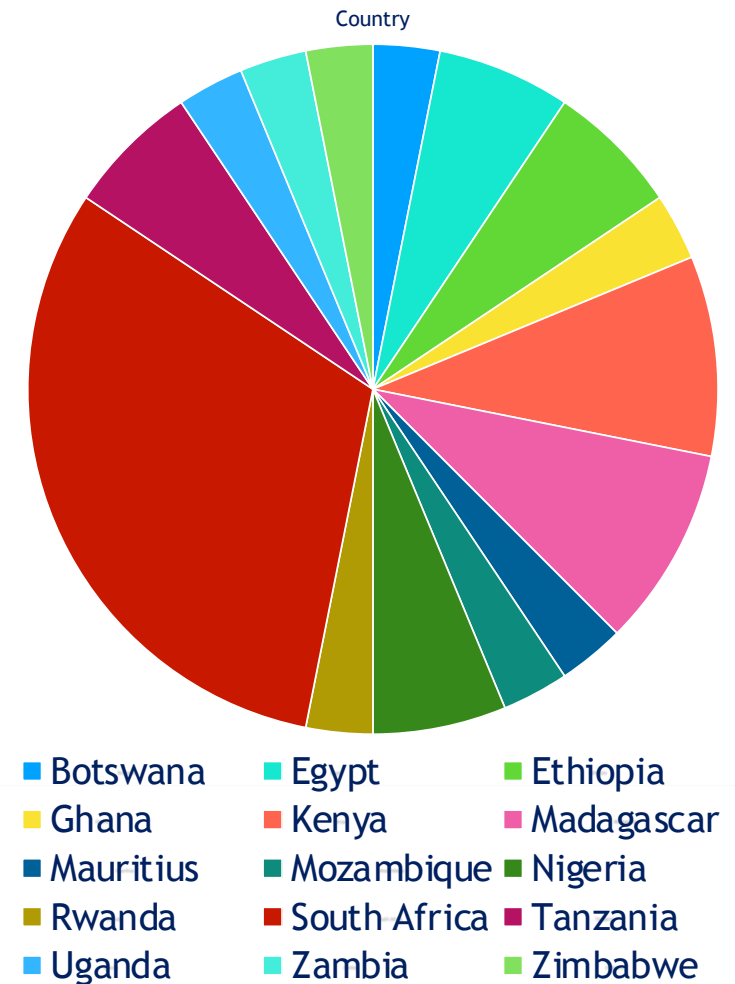
Academic staff (1)

Educators who want to use VO tools in their teaching (7)

Undergraduate (1)

MSc/PhD students (21)

Postdoc (2)



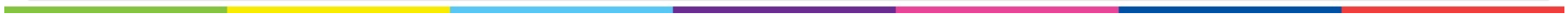


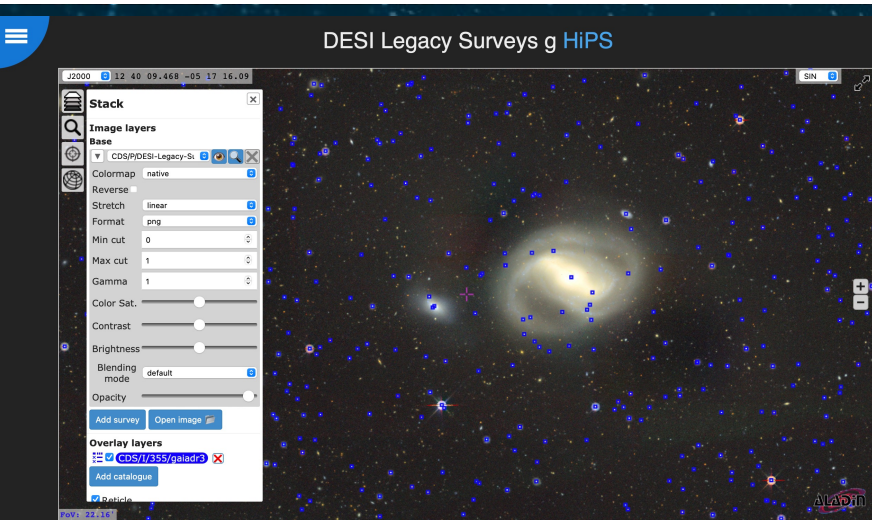
This workshop...

Will introduce tools and services for accessing a wide range of astronomical images, catalogues and other types of data.

Emphasize an ‘all sky’ approach, and the combination of data.

Is aimed at postgraduate students, postdoctoral researchers for their own research, and also university staff interested in using these tools in their teaching.





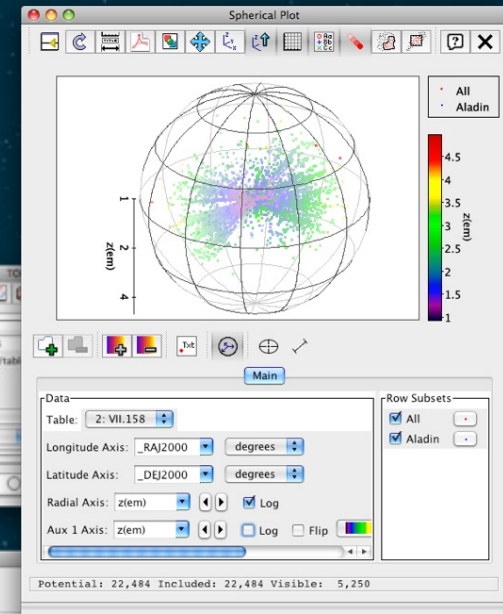
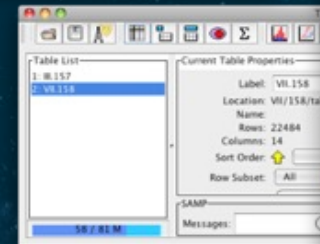
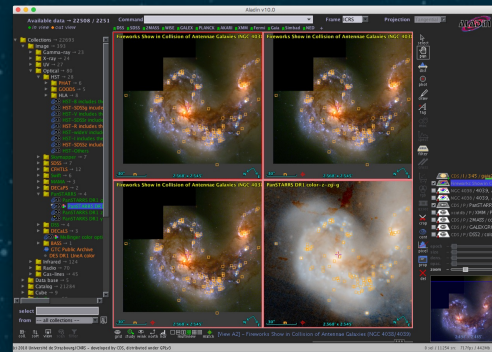
Access to PB-scale all-sky data

```
In [ ]: 1 from ipyaladin import Aladin
2 a = Aladin(target='18 55 24.508 +04 29 46.72', survey='P/Mellinger/color', fov=180)
3 a

In [ ]: 1 a.survey = 'P/GALEXGR6/AIS/color'; a.target = 'M101'; a.fov = 0.3

In [ ]: 1 nloadTableOutputFormat=vot&filename=vizier_M101_II_328_allwise_20190322', {'color': 'red', 'onClick': 'showTable'})
2
3
```

VO interoperability –



Virtual Research Environment of:
Services, apps, **notebooks**, platforms, APIs, ...

Software installation instructions

Virtual Observatory Workshop : software installation instructions

Please be sure to install the following software prior leaving for the IAU. If you have any questions or troubles installing, you can reach :

- mark.allen@astro.unistra.fr
- matthieu.baumann@astro.unistra.fr
- priya.hasan@gmail.com
- manon.marchand@astro.unistra.fr
- pooja.sharma@astro.unistra.fr

and we'll do our best to assist you.

1 Aladin and TOPCAT

1.1 Installation

Aladin and TOPCAT are both developed in Java. This means that you need a [Java virtual Machine](#) to execute these software. Follow the instructions on this link [TOPCAT's website](#).

Then, you can download the files corresponding to your operating system respectively on [Aladin's website](#) and [TOPCAT's website](#).

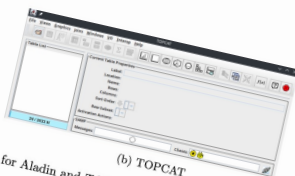
TIP : If you're using Ubuntu, Debian, or Arch linux, your package managers have Aladin desktop registers under aladin and TOPCAT under topcat.

1.2 Checking the installation

The two software look like this when everything is right. The Aladin version should be at least v12 to be able to follow the tutorials, see the top .



(a) Aladin



(b) TOPCAT

FIGURE 1 – Launch screens for Aladin and TOPCAT

2 Python

2.1 Getting python

Python is already installed on a lot of operating systems. To check if you already have it, open a terminal and type :

```
python3 --version
```

The response should look something like Python 3.12.2. The version should be comprised between 3.12 (or 3.11) If you are on Windows, it is possible that you'll have to type py instead of python3. If this worked, you are good to go and you can go to the virtual environment setup. If neither of these work, or if your version is too old, follow the [installation instructions for Python](#).

2.2 Setting a virtual environment

It is good practice to always have one virtual environment per project. **What problem does a virtual environment solve?** The more Python projects you have, the more likely it is that you need to work with different versions of Python libraries, or even different versions of Python itself. Newer versions of libraries for one project can break compatibility in another project. Virtual environments are independent groups of Python libraries, one for each project. Packages installed in a project will not affect other projects or the operating system's packages. Python comes bundled with a module to create virtual environments, we will use it here.

a. If you already use an other virtual environment package, such as miniconda or uv, use your own rather than venv (important) :

```
python3 -m venv .
```

This will create the files needed for this virtual environment. We can activate the environment with :

On windows :

```
# In cmd.exe
venv\Scripts\activate.bat
# In PowerShell
venv\Scripts\Activate.ps1
```

On Linux and MAC :

```
source bin/activate
```

The virtual environment is now activated. You can check it by looking at the list of python packages installed in this virtual environment with pip3, the Python package manager :

```
pip3 list
```

You should only have pip3. We can install the libraries we need in this fresh environment :

1. On windows, the terminal is called Command prompt.
2. These are the currently valid python versions you can always check which version is currently valid on [Python's life-cycle page](#).
3. doing pip3 list after this will return a lot of packages. These are all the dependencies of those 4 libraries.

```
pip3 install jupyterlab==4.0 mopy==0.14.0 ipyaladin==0.3.0 astroquery==0.4.7
```

And launch jupyterlab with

```
python3 -m jupyterlab
```

And voilà, you are ready to code in python! When you want to switch off Jupyterlab and the virtual environment, you can do ctrl + C in the terminal from which you launched the notebook, say y to confirm that you want to leave. When the prompt is available, do deactivate to leave the virtual environment.

2.3 Checking the installation

If you've never used Jupyterlab, we strongly advise you to watch this [short video introducing the interface](#). When you launch JupyterLab (with python3 -m jupyterlab), you should see the square Python button in figure 2a. Upon clicking on it, a notebook appears. Copy paste

```
import mopy
import astroquery
import pyvo
import ipyaladin
```

in the first cell, press shift+enter to execute the first cell. If it looks like figure 2b, then you're good to go!

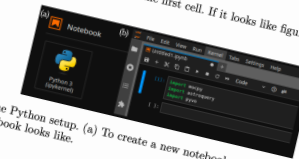


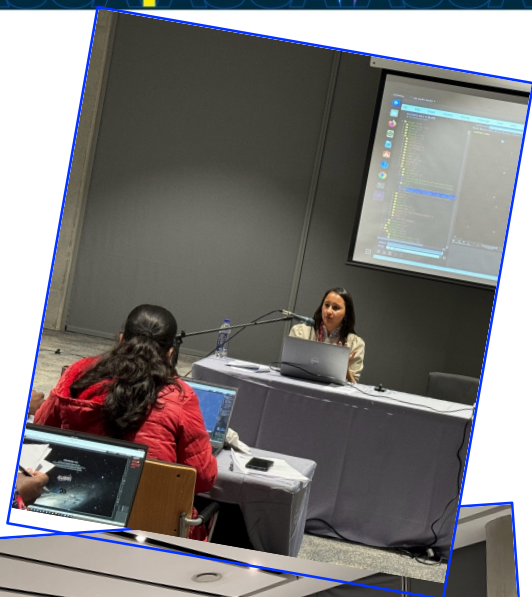
FIGURE 2 – Checking the Python setup. (a) To create a new notebook, click on the python square button. (b) How the inside of a notebook looks like.

3 Conclusion

Don't hesitate to join us with any question (related to the installation, to the content of the workshop, to anything VO...).

Also keep in mind that there is a time dedicated to you personal questions/projects. You can prepare data files, scientific goals, outreach questions, ... and we'll do our best to see how these could be solved (or not, maybe you need something that is yet to be built?) with VO tools.

See you all at the workshop!



Virtual Observatory Tools for Students and Educators

The emphasis of this event is to enable the participants to discover and use openly available data for their research projects and educational activities.

10h30 Introduction to the Virtual Observatory and CDS services : Aladin, VizieR, SIMBAD

12h Lunch

13h30 Programmatic access to VO services using Python

15h Coffee Break

15h30 Interactive tutorial on Gaia data and Kepler data

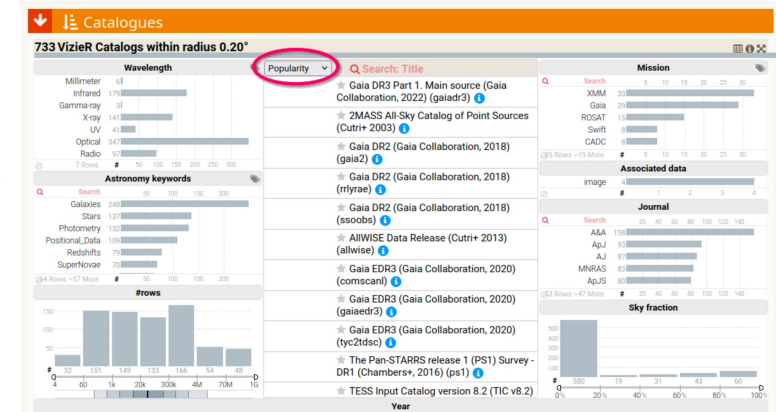
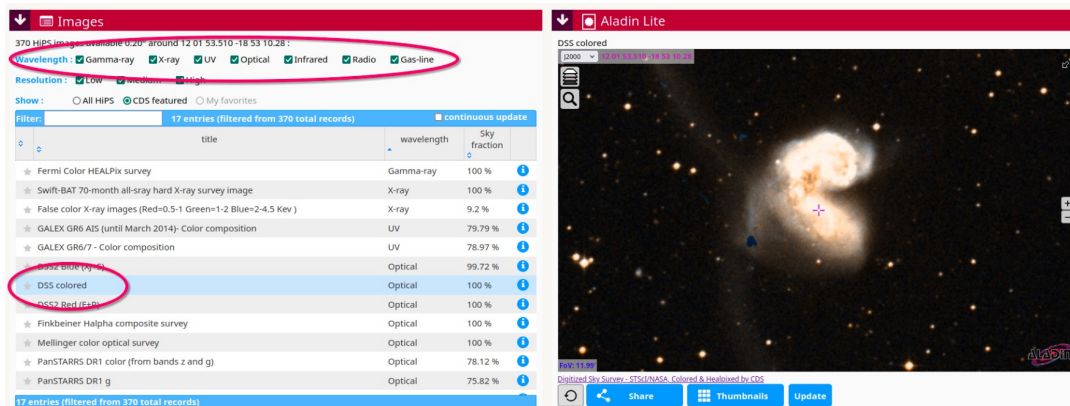
17h Break

17h15 Support of Participants 'projects and extra resources.

An informal session where the tutors will be available to discuss with participants about their use of VO tools and services for their own projects.

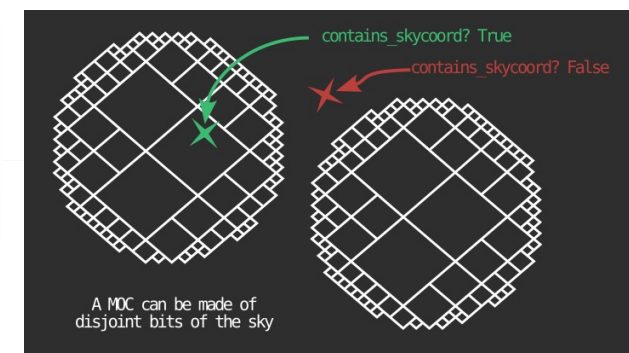
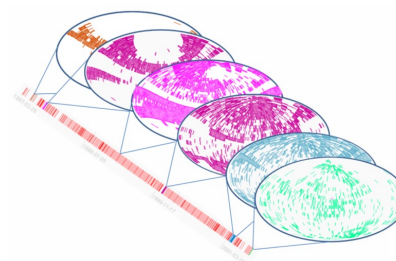
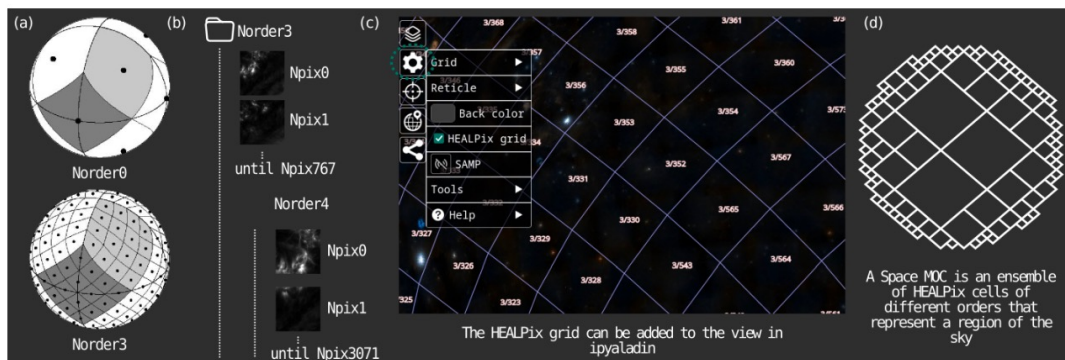
Tutorial: Introduction to the Virtual Observatory and CDS services : Aladin, VizieR, SIMBAD

- Interactive web interfaces of VizieR, SIMBAD, CDS Portal
- Science use case of exploring data on NGC 4039
- Aladin Desktop and Aladin Lite applications.
- We will present how data catalogues and hundreds of multi-wavelength imaging surveys can be found and visualised.




Tutorial: Programmatic access to VO services using Python

- Science use case: GRBs in Fermi, XMM and catalogues.
- PyVO, astroquery, astropy, and MOCpy.
- ipyaladin for visualisation in Python notebooks.
- Concept of spatial and temporal coverage (ST-MOC).



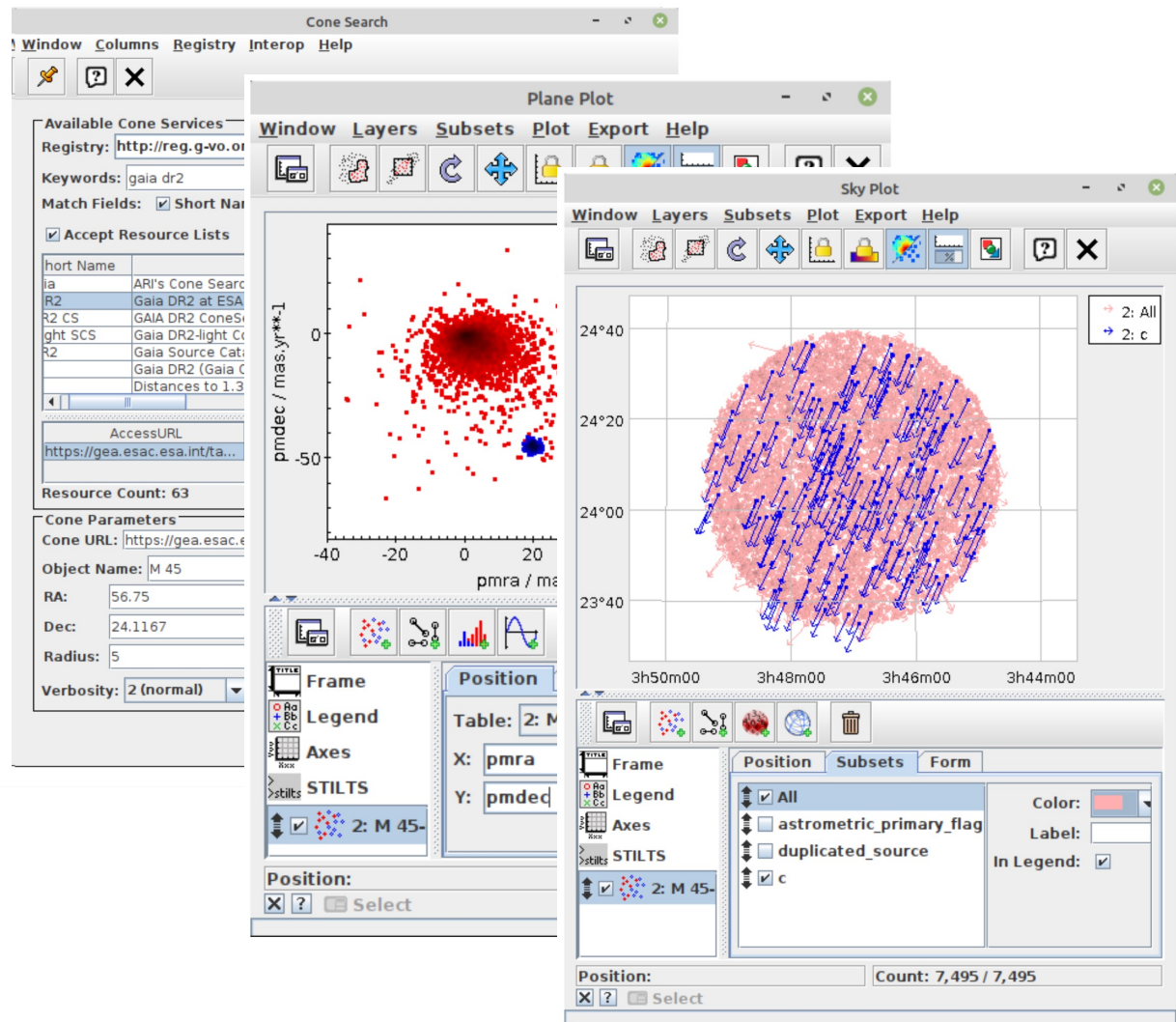
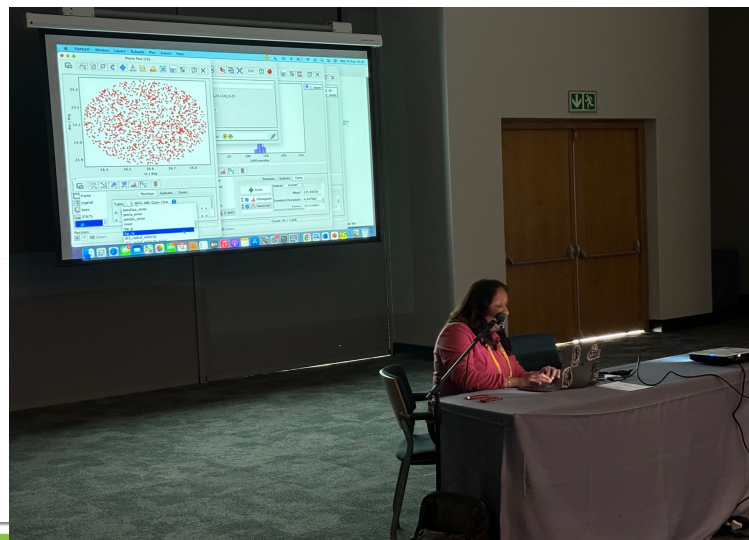
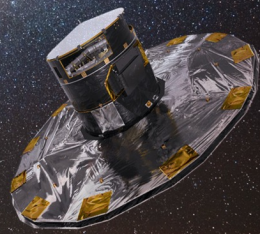


Tutorial: Science use cases with **Gaia**, **Kepler**, **TESS**

- i. Gaia DR3 data to identify probable members of an open cluster:
 - plotting its HR diagram and estimating its distance.
 - ii. Exoplanet detection using Kepler data from MAST:
 - determine parameters: period, mass, distance, T and density.
 - iii. TESS data for the determination of exoplanet parameters
 - TOPCAT, Aladin, and then links to Jupyter Notebook.
- 

The Milky Way (revealed) in the Gaia Era

Dr Priya Hasan
Asst Professor in Physics
Maulana Azad National Urdu University
Hyderabad
priya.hasan@gmail.com






Support of the participants' projects and provision of extra resources.

An informal session where the tutors will be available to discuss with participants about their use of VO tools and services for their own projects.

Provision of a Jupyter notebook that creates a multi-color image mosaic with Montage.



Materials listed on IVOA wiki: python notebooks, pdfs, video links



TWiki > IVOA Web > IvoaStdsDocsProc > TrainingMaterialsAndPresentations (2025-05-28, MarkAllen) [Edit](#) [Attach](#)

Training Materials and Presentations

This Twiki page is available for people to upload training and presentation materials of all kinds related to the VO, or to provide links to such materials that reside on project web sites or other on-line publications.

Such material can also be put in the VO registry. [VOTT](#) (VO Texts and Tutorials) is a browsable list of registered training and outreach material.

Project Materials


Project	Description	Link
EuroVO Scientific tutorials (fully developed example science cases)		Link
EuroVO Selected presentations of general interest		Link

Event Materials

Date	Event/Author	Description	Link
2024 August	Virtual Observatory Tools for Students and Educators	Mark Allen, Matthieu Baumann, Manon Marchand, Pooja Sharma (CDS), Priya Hasan (MANUU), Bruce Berriman (IPAC), postdoctoral researchers for their own research, and also university staff interested in using these tools in their teaching within Africa.	CDS tutorials: Link Caltech tutorial: Link Gaia tutorial: Link priya_gaia_tut.pdf Kepler tutorial: Link kepler_data.pdf
2011 March	EuroVO-ICE School	Euro-VO The Euro-VO project, in the framework of the Euro-VO International Cooperation Empowerment (EuroVO-ICE) project, is running one 'VO School' in Strasbourg on 21-24 March. Like for previous schools, the goals are to	Link



Summary

- **Participants had a wide range of skills and experience:**
 - Addressed with adaptation, and personalized help.
 - **Pre-installations mostly worked, but some help needed.**
 - Setting up a dedicated environment a good choice.
 - **Animated tutors encouraged interaction 😊.**
 - Essential to have scientific and technical tutors!
 - **Notebook tutorials:**
 - Pros: each step works, tutorials are robust, easily re-usable.
 - Cons: risk of clicking through too fast...
 - **Great to be integrated as part of a big meeting.**
- 

Links

- IVOA Training materials page: <https://wiki.ivoa.net/twiki/bin/view/IVOA/TrainingMaterialsAndPresentations>
- CDS notebook tutorials: https://github.com/cds-astro/tutorials/tree/master/Past_Conferences_and_Schools/2024_IAU_VO_workshop
- CDS intro tutorial (pdf): https://wiki.ivoa.net/internal/IVOA/TrainingMaterialsAndPresentations/IAU_School.pdf
- Video of the CDS tutorial: <https://pod.unistra.fr/video/57005-introduction-to-the-main-cds-services>
- IPAC-Caltech Montage tutorial: <https://github.com/Caltech-IPAC/MontageNotebooks/blob/main/MeerKAT.ipynb>
- Gaia tutorial (pdf): https://wiki.ivoa.net/internal/IVOA/TrainingMaterialsAndPresentations/priya_gaia_tut.pdf
- Kepler tutorial (pdf): https://wiki.ivoa.net/internal/IVOA/TrainingMaterialsAndPresentations/kepler_data.pdf