

State of the IVOA

15-17 November 2024 Interoperability Meeting

Valletta, Malta

Simon O'Toole
IVOA Chair



ALL-SKY
VIRTUAL
OBSERVATORY



Current IVOA chair and vice-chair

Simon O'Toole - Chair
Nov 2023 - April 2025



JJ Kavelaars - Vice Chair
Nov 2023 - April 2025



What is the IVOA?

- IVOA founded in 2002
- 23 member projects
- Two interoperability meetings per year:
 - “Northern Spring”
 - “Southern Spring” (typically after ADASS)



Vision of the IVOA

Develop a FAIR data management framework for astronomy

- Interoperability standards (VO framework) amongst astronomical (ground and space based) archives
- Publishing tools for data centres

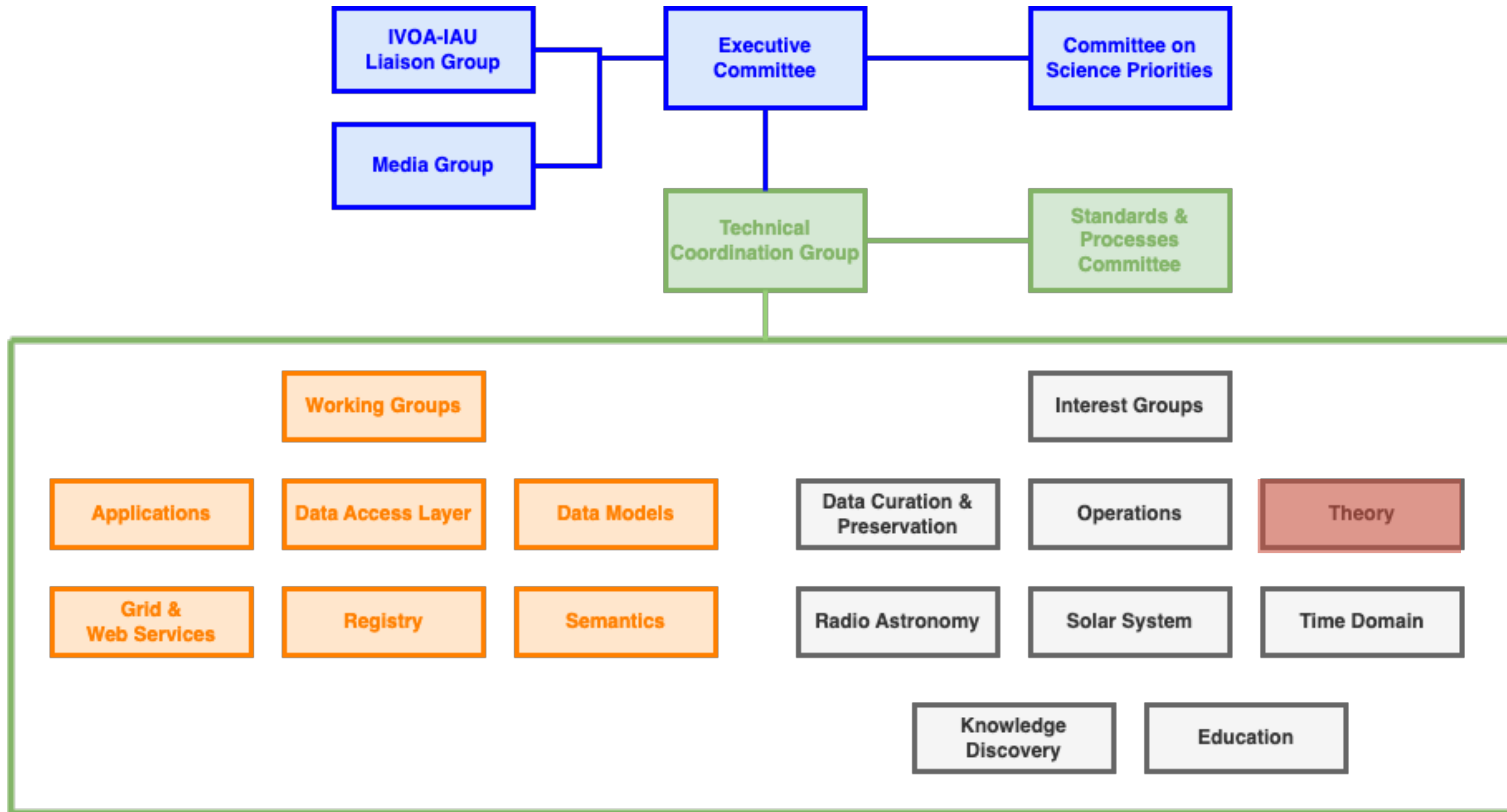
Enable new science through the VO

- Multi wavelength science, combining datasets from multiple sources
- Data discovery and data access tools
- Data analysis and visualization tools

World wide collaboration amongst astronomical VO projects

- No formal funding, nationally funded projects
- Diversity makes IVOA's richness

IVOA Organisation



Working and Interest Groups

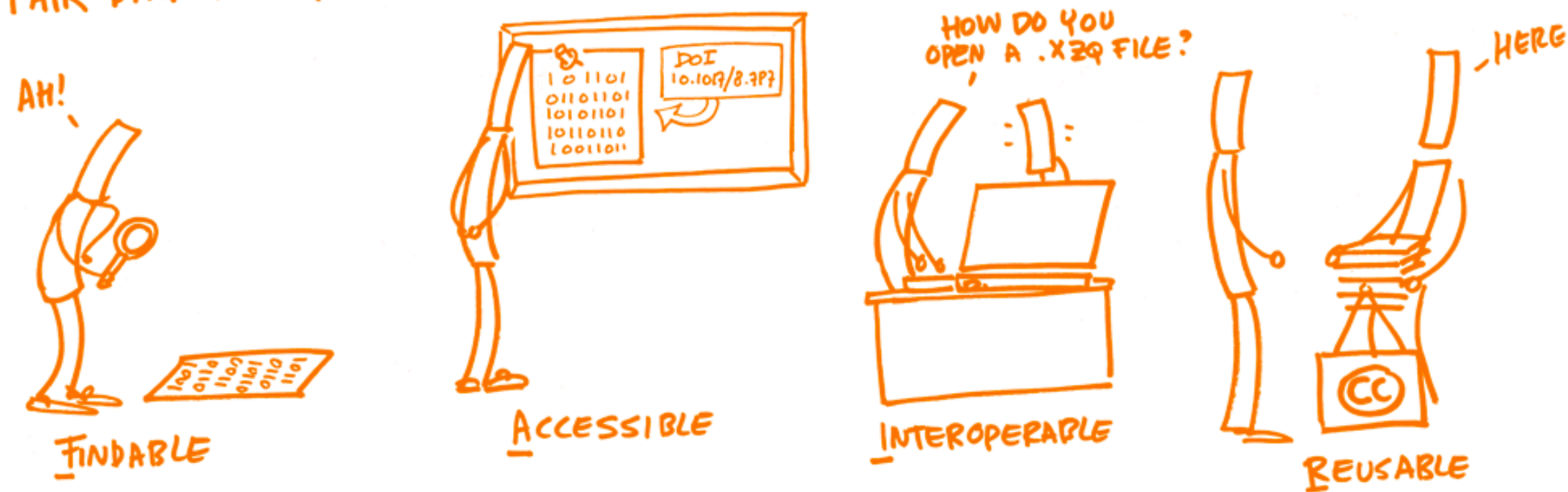
- WG/IG chairs and vice-chairs are three year terms, with one year extension possible
- There are currently two open vice-chair positions:
 - Education
 - Knowledge Discovery
- Note: Theory IG is currently on hiatus

	Chair	Vice-Chair
TCG	Marco Molinaro	Tom Donaldson
Working Groups		
Applications	Pierre Le Sidaner	Adrian Damian
Data Access Layer	Gregory Mantelet	Joshua Fraustro
Data Model	Mark Cresitello-Dittmar	MathieuServillat
Grid and Web Services	Jesus Salgado	Sara Bertocco
Registry	Renaud Savalle	Tess Jaffe
Semantics	Baptiste Cecconi	Sebastien Derriere
Interest Groups		
Data Curation & Preservation	Gilles Landais	Gus Muench
Education	Shanshan Li	OPEN
Knowledge Discovery	Yihan Tao	OPEN
Operations	Steve Groom	Tamara Civera
Radio Astronomy	Mark Kettenis	Ricardo Rizzo
Solar System	Anne Raugh	Markus Demleitner
Time Domain	Rafael Martinez Galarza	Pierre Fernique
IVOA Committees		
Exec	Simon O'Toole	JJ Kavelaars
Science Priorities	Francesca Civano	Vandana Desai
Standard and Processes	Patrick Dowler	
IVOA IAU Liaison Committee	Bruce Berriman	

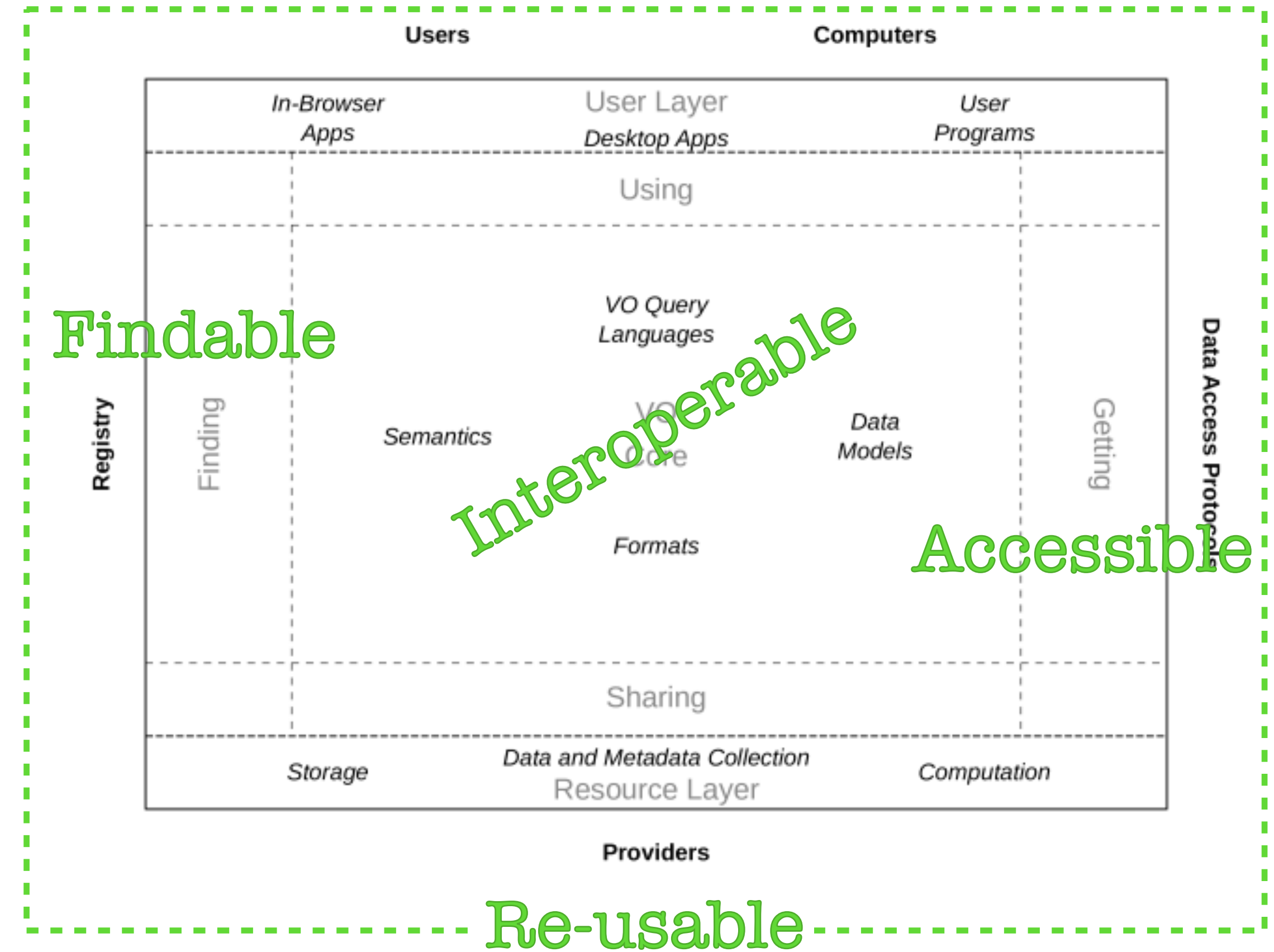
IVOA Architecture – FAIR Data

The Virtual Observatory has been FAIR from the beginning!

FAIR DATA PRINCIPLES

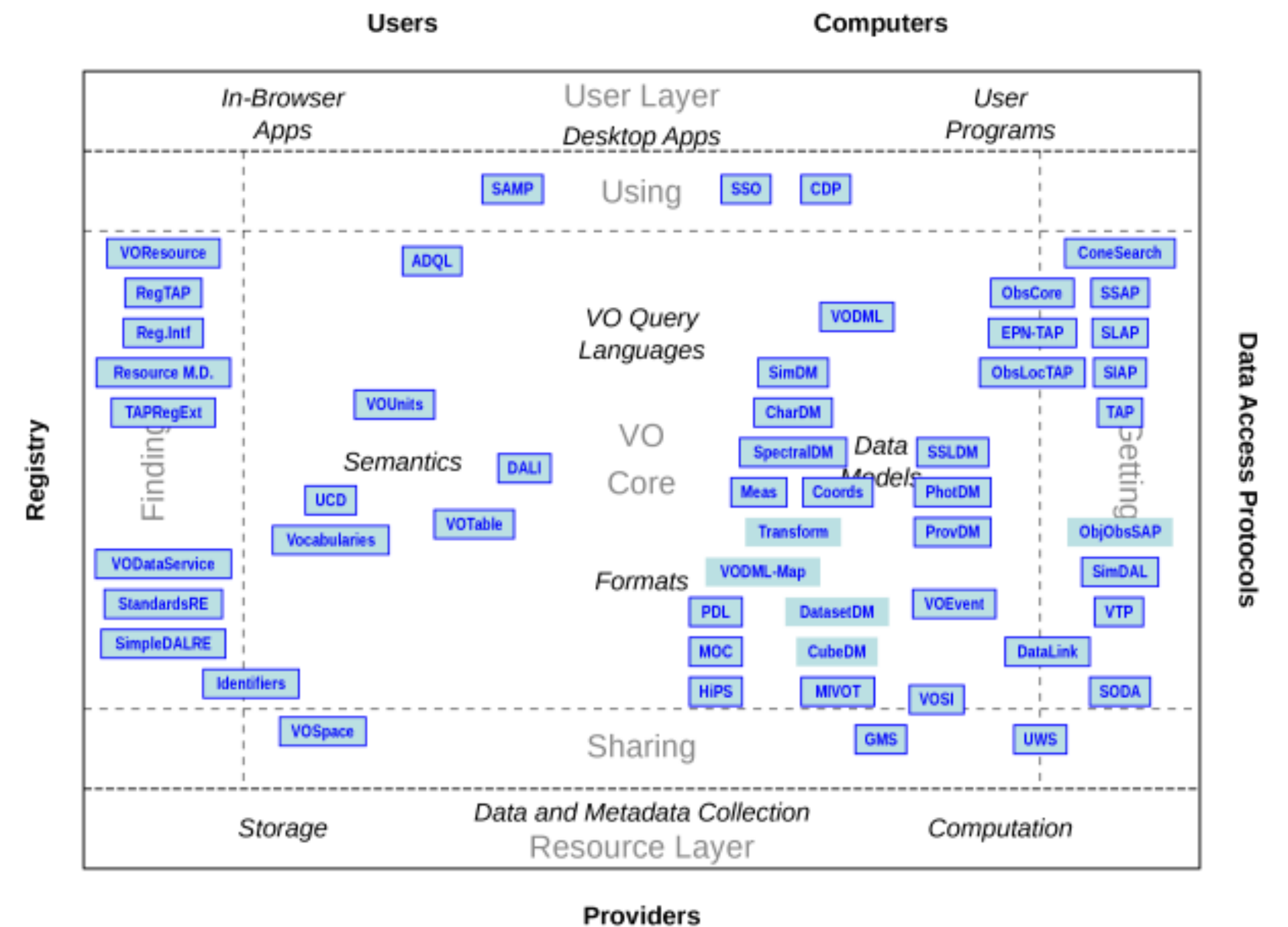


<https://www.fosteropenscience.eu/learning/assessing-the-fairness-of-data/>



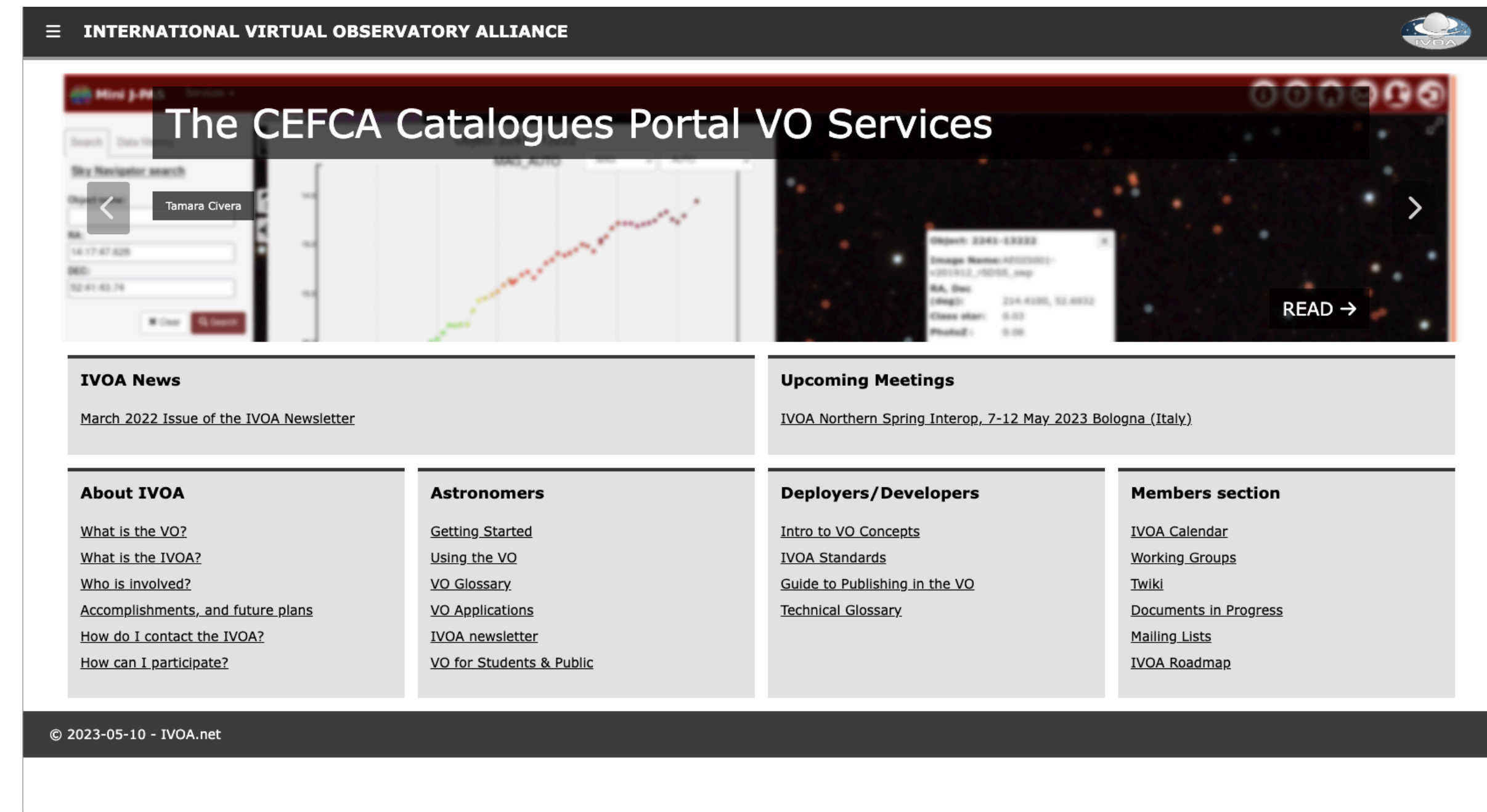
IVOA Architecture – All the Standards

- IVOA Architecture v2.1, last updated on 2024-10-25
- Recently endorsed!
- IVOA is an open community – if a standard is close but doesn't fit – implement an extension & provide feedback to influence change to the standard



IVOA Website – we need YOU!

- New look and feel - see https://sdc-dev.astron.nl/ivoa_web/
- We need help to update and improve accessibility for Developers and Scientists
- Intro slides and worksheets: <https://tinyurl.com/3x9jtvdy>



Documentation Hackathon - Wednesday 14:00 onwards in C122

IVOA Newsletter – call for volunteers!

- The Newsletter will return!
- A great way to tell the IVOA and the world about the cool new projects you're working on!
- Advertise new services, workshops and other activities
- For this to happen we need 2-3 editors to volunteer – once a year
 - Call for and collate articles and items
 - Aiming for July releases



VO Project Updates

Armenian VO co-organized meetings and schools

06-08.05.2024 – Symposium *Relation of Astronomy to Other Sciences, Culture and Society*

Session on **Astroinformatics and VOs**

09-13.09.2024 – 9th Byurakan International Summer School (9BISS) *Astronomy as the leader of Interdisciplinary and Multidisciplinary Sciences*

Lectures:

- *Astronomy and Computer Science*
- *Astronomical Surveys and Virtual Observatories*

All-Sky Virtual Observatory



- Data Central
 - Publish two major data sets:
 - GALAH Data Release 4 (AAT optical spectra and catalogues)
 - GLEAM-X Data Release 2 (MWA imaging and catalogues)
 - Aiming to register TAP service (at last!) in coming months
- MWA
 - ASVO node moving to Setonix supercomputer at Pawsey

Canadian Virtual Observatory - Highlights

Submission of CAOM2.5 as a proposed standard for an Archive Data Model.

- CAOM2 is in use in the CADC to run our archive Storage Inventory service providing a rich metadata model and enabling data and metadata access controls.
- CAOM2 is now in use at CADC, ESAC and MAST.
- CAOM2.5 extends CAOM2 to enable radio astronomy metadata.

Extension of TAP.

- User schemas for long-lived tables in TAP.
- Parquet as results and upload format.

OpenAPI

- Contributing to development of OpenAPI interfaces for TAP and other services.
- Use of JSON for service interoperability



Astronomical Data Processing & Virtual Observatory 天文数据处理与虚拟天文台

published in October 2024

Chapters in part II, i.e. Virtual Observatory:

1. The driving force behind the VO
2. Architecture and technical standards of the VO
3. Tools and services of the IVOA
4. Chinese Virtual Observatory
5. Prospects and future outlook



天文数据处理与虚拟天文台

赵永恒 崔辰州 编著

本书包括相对独立的两个部分，即“天文数据处理”和“虚拟天文台”。

第一部分介绍了天文观测数据的来源以及常用的数据处理方法，如统计学基础、数据分析方法、最小二乘法、周期分析、最大似然估计、贝叶斯估计、大数据分析等。

第二部分介绍了虚拟天文台的标准规范、技术架构、发展前景，国际上以及中国虚拟天文台（国家天文科学数据中心）的资源服务。

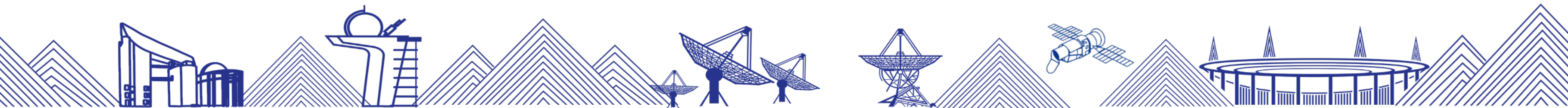
中国科学院国家天文台天体物理技术与方法丛书

中国科学技术出版社
CHINA SCIENCE AND TECHNOLOGY PRESS

丛书还包括：
☆ 天文可见光探测器
☆ 天文望远镜设计
☆ 天文望远镜光学系统
☆ 天文光学非球面技术和系统调整

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使用京东 APP 或微信扫码



Visit to Maltese Embassy in China



<https://www.facebook.com/share/p/14daATaArw/>

ESA Archives and VO highlights for IVOA Malta Interop - November 2024

Christophe Arviset

15/11/2024

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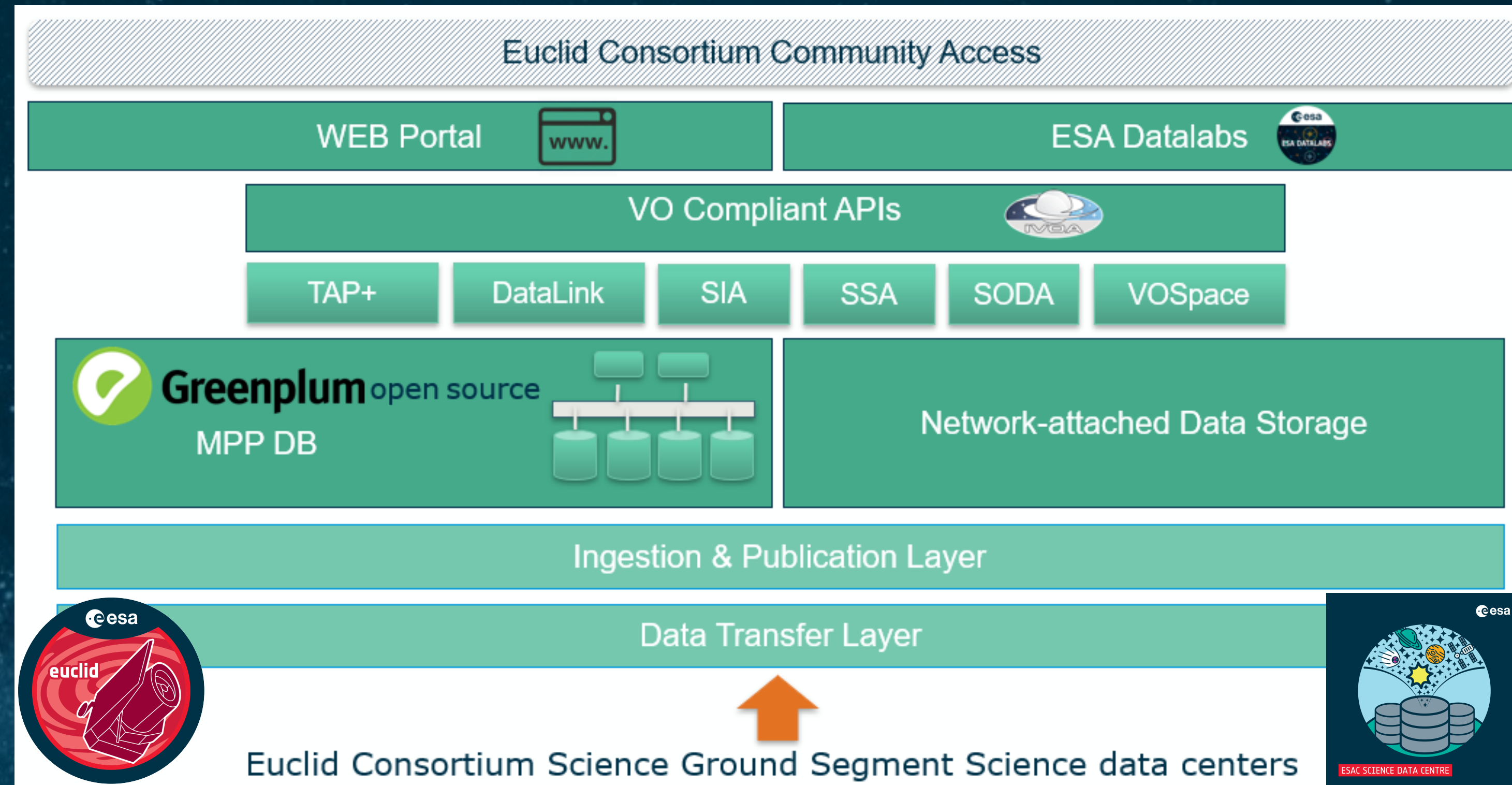
Euclid Archive Internal Quick Release #1: the VO in action

QR#1 of 50 deg2 (exclusive-access data) released on 6th Nov to the Euclid Consortium and the Euclid interdisciplinary scientists and their teams

- Release with a limited sky coverage intended to familiarise scientists with the Euclid data and capabilities.
- Includes a subset of the Euclid scientific data products (no cosmological analysis)

QR1 data will be released publicly in March 2025.

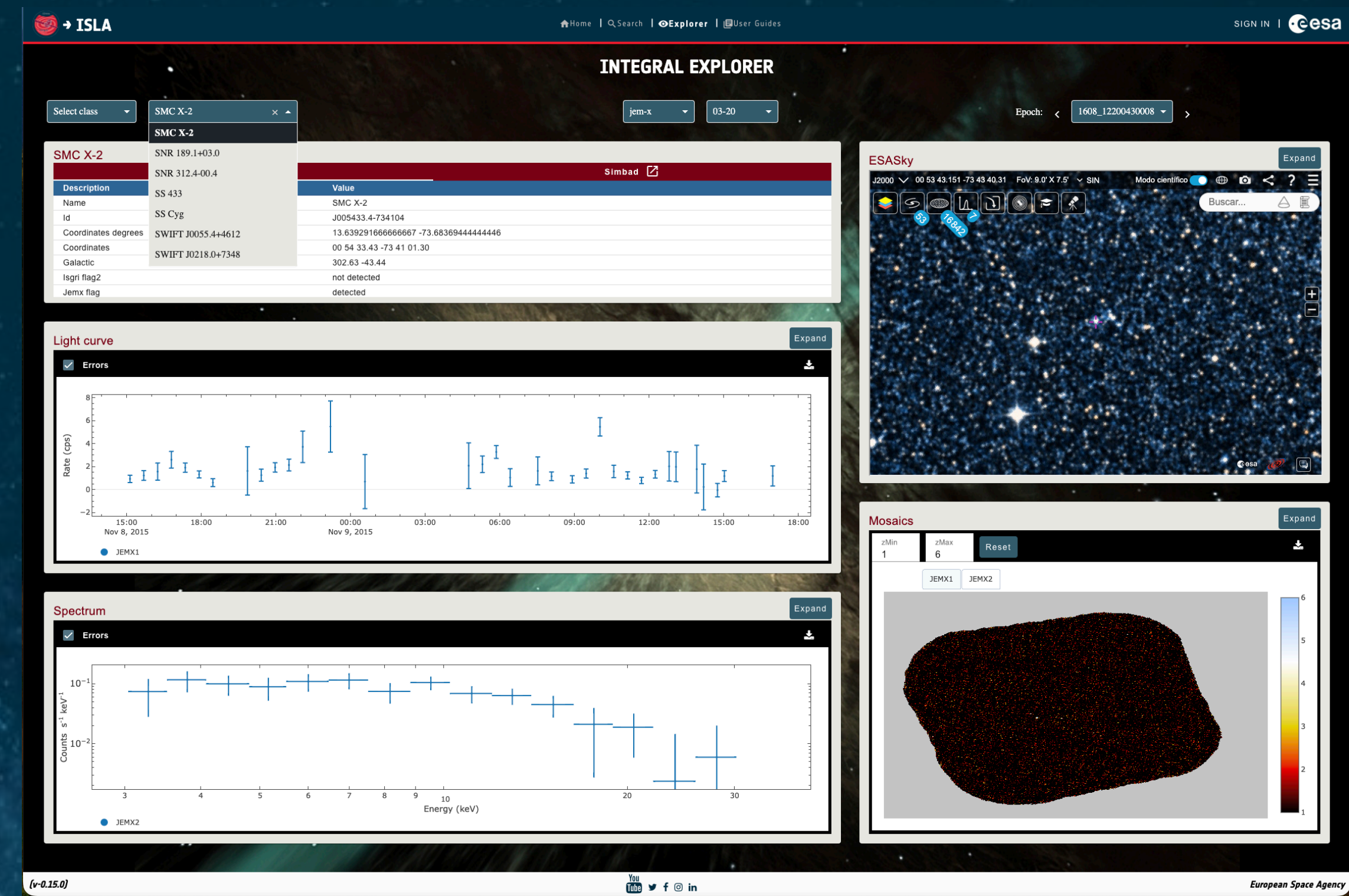
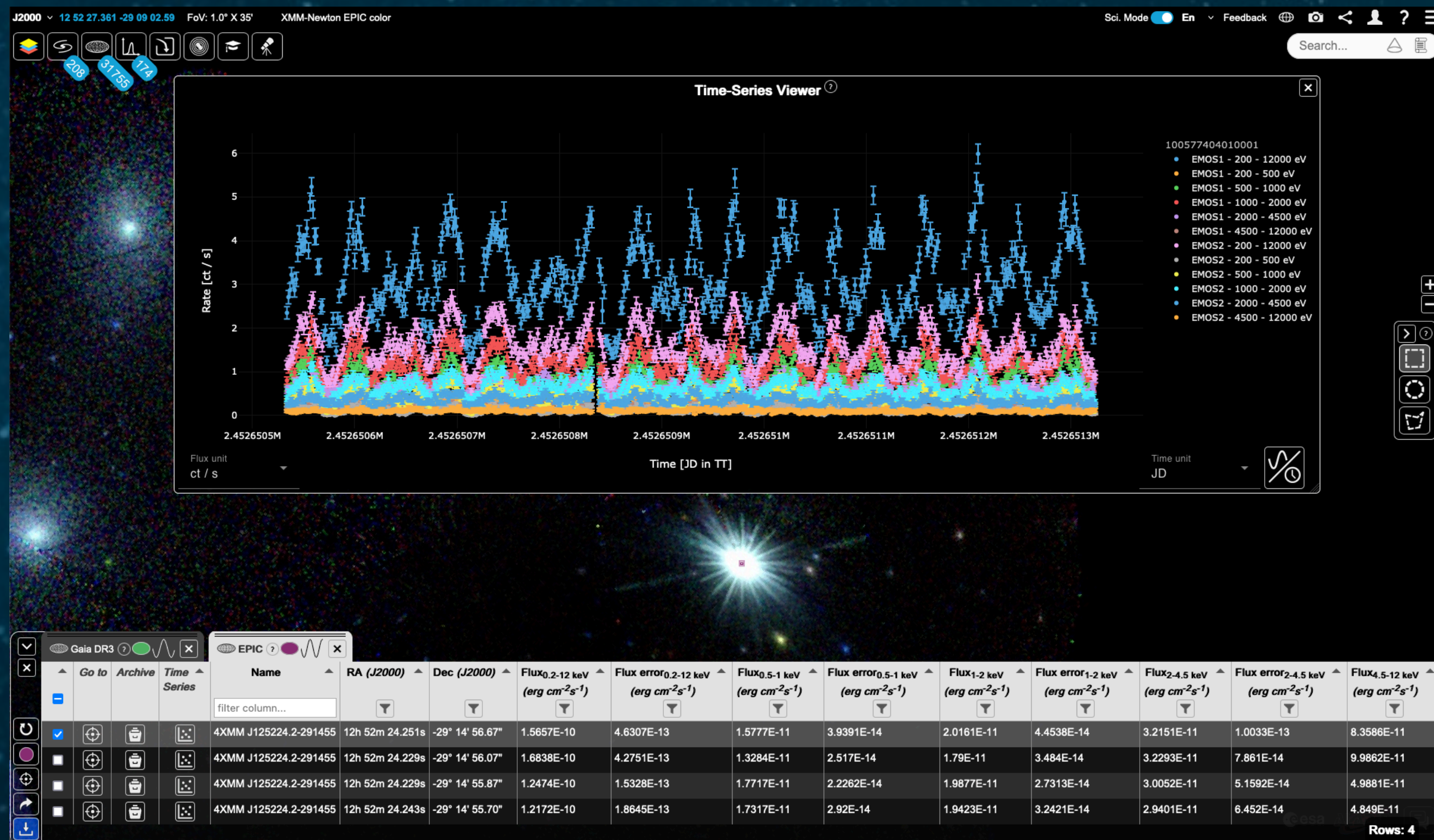
First major public Euclid data released scheduled for the second half of 2026



IVOA services requests after one week (13/11)

- 40.136 TAP Sync requests
- 22.329 TAP Async requests
- 8.170 SIAP requests
- 10.040 Cutout requests
- 18.637 Download requests of FITS files
- No DataLink products yet

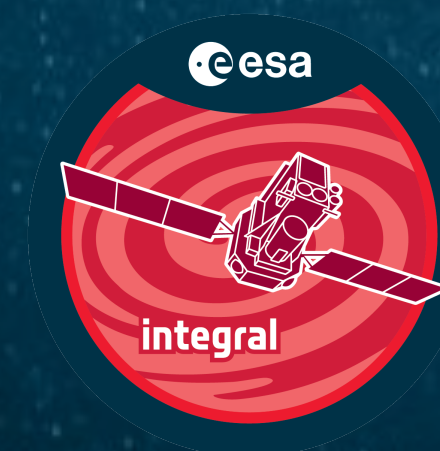
ESAC Science Data Centre (ESDC) – Archives Highlights



ESASky v7.0 released in November 2024
 Time-Series Viewer
 Upgrade to Aladin Lite 3
 More data and HiPS added

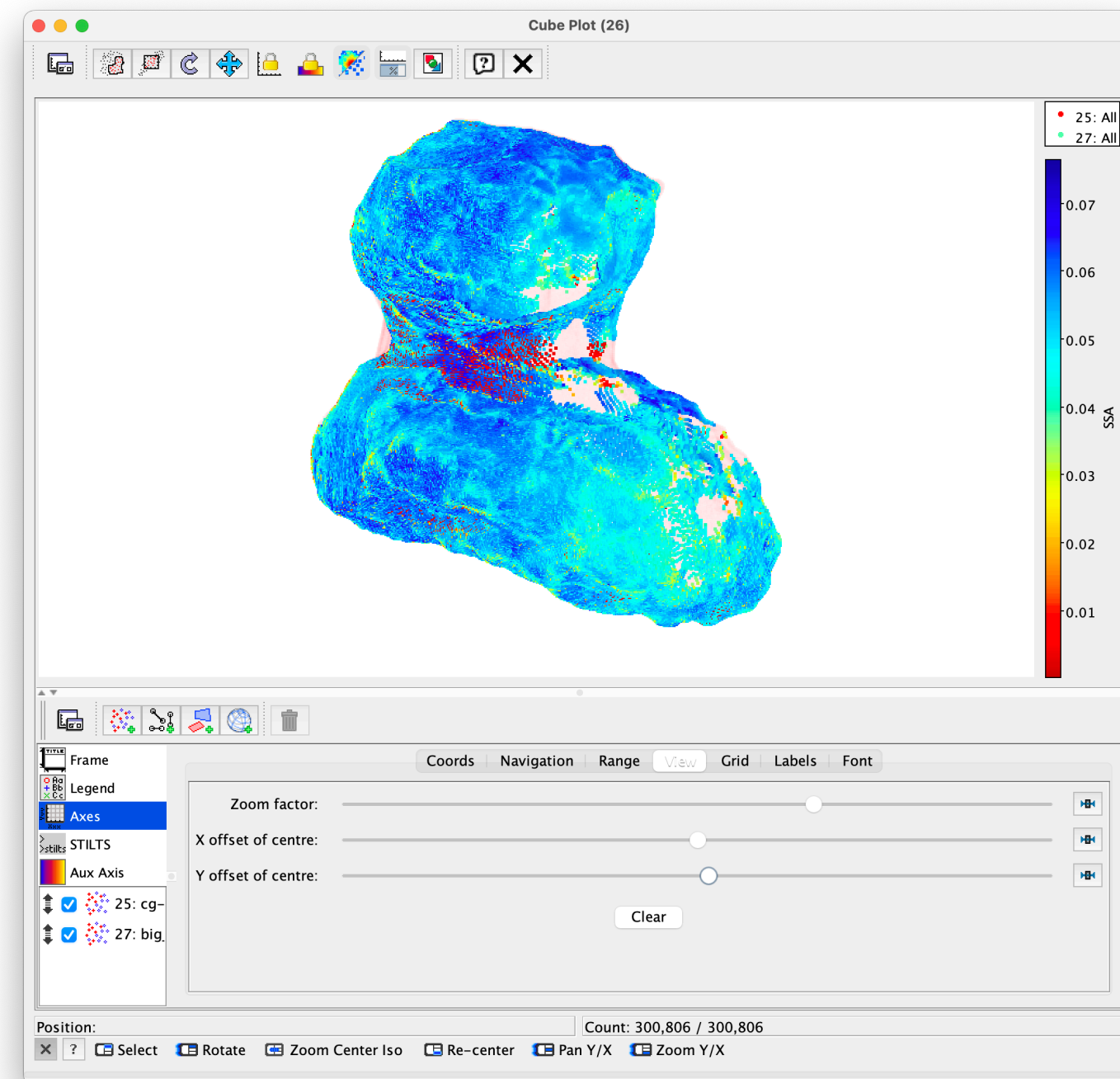


Integral Science Legacy Archive (ISLA)
 Beta release in October 2024
 Usual TAP services



News from VESPA:

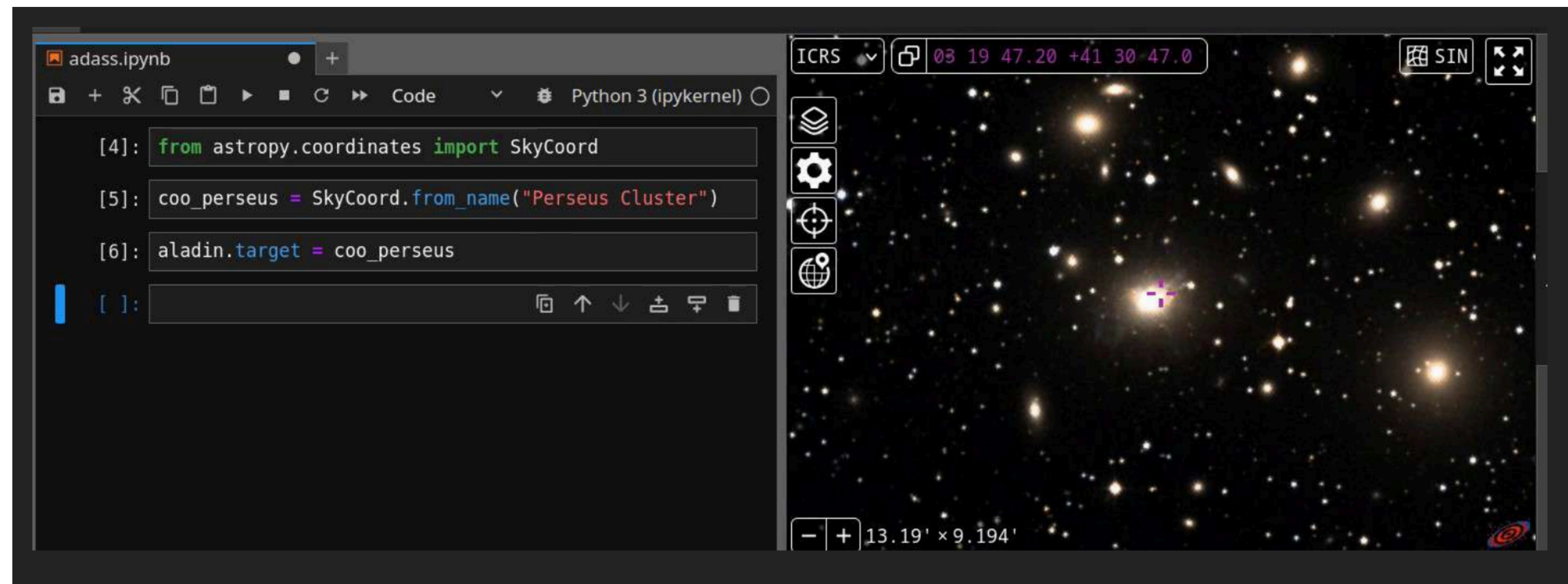
- End of contract Europlanet RI in July 2024
- New website <https://vespa.obspm.fr>
- 91 published services EPN-TAP
- 69 HiPS on planetary sciences
- Geospatial portal under development in collaboration with the CDS (AladinLite)
- Interface EPN-TAP for PDS4 data collections (NASA/ESA/JAXA)
- Shape models of small bodies can now be visualised on Topcat!



Comet 67P seen by VIRTIS/Rosetta displayed by Topcat

News from the CDS:

- CDS participation in SKA SRCNet prototyping: implementation of VO standards based on SRCNet needs (HiPS, ObsCore, SODA, Aladin Lite)
- New web pages <https://cds.unistra.fr>
- Jupyter notebooks available for each VizieR catalogue! (pyvo, mocpy, ipyaladin)
- CDS “Open Data for Astronomy” project funded: ObsCore for ‘associated data’ from journals
- ipyaladin improved compatibility with Astropy, supports MOC, supports FITS, ...)
- mocpy: faster methods (from_cones, from_boxes), new methods (MOC from Astropy regions,...). Collaboration with various research groups (Goddard, LINCC, LIGO)





German Astrophysical Virtual Observatory

- Lecture on the use of the VO in summer semester with near-textbook
 - lecture notes here <https://blog.g-vo.org/learn-to-use-the-vo.html>
- Global image discovery is in pyVO 1.6 <https://blog.g-vo.org/global-dataset-discovery-in-pyvo.html>
- Experiments on TAP persistent Uploads (DaCHS beta 2.10.2) <https://blog.g-vo.org/a-proposal-for-persistent-tap-uploads.html>
- DaCHS 2.10 (VODDataService 1.3 preview, TableReg prototype and much
 - more <https://blog.g-vo.org/what-s-new-in-dachs-2-10.html>
- DASCH in the VO <https://blog.g-vo.org/dasch-is-now-in-the-vo.html>

NAVO past 6 months activity summary for November 2024 Interop

- **Standards**
 - P3T (Protocol Transition Tiger Team) work on draft UWS OpenAPI
- **Implementations:**
 - P3T FastAPI package for UWS and vo-models for VOResource, VOSI, UWS, TAPRegExt, etc. **(see talk by J. Froustro, TBC)**
 - NAVO archives continue to coordinate our ObsTAP+DataLink development.
 - Designing, implementing, and testing new ObsTAP and DataLink services **(see talk in DAL by A. Laity)**
 - NAVO continues to contribute to PyVO maintenance and development.
 - Reviewed major data discovery PR.
 - Released 1.5.3. Preparing 1.6.
 - Firefly has expanded its integration of IVOA concepts to create universal user-friendly interfaces **(see talk by T. Roby in Apps)**
 - NAVO Python notebook testing under CI/CD **(B. Sipócz in Apps TBC)**
- **Metadata:**
 - ObsCore tables being developed/modified to provide a consistent user experience.
 - VOTable metadata expression in Parquet format **(see discussion introduced by Mark Taylor in DAL, w/ B. Sipócz)**
 - IRSA has released simulated data via ObsTAP and SIA2, making implementation and metadata decisions **(see talk in DAL by A. Laity)**
 - Re-starting discussion of how to specify multiple access locations including cloud with DataLink **(see talk in DAL by T. Jaffe)**
- **Outreach:**
 - B. Berriman organized a session on "Community Engagement, Open Science and the Virtual Observatory" at IAU General Assembly in South Africa
 Went very well, paper in prep. (Plus other IAU related work.)

NAVO agenda for this Interop

- Presentations:
 - Joshua FRAUSTRO: status of P3T draft of OpenAPI spec for UWS, vo-models, etc. (TBC)
 - Anastasia LAITY: update regarding NAVO experience so far in trying to implement cross-archive ObsCore+DataLink services that will allow smooth and consistent user experience across all NASA missions. ([DAL](#))
 - Tess JAFFE: ideas for using DataLink in a consistent way to provide alternative locations for fetching data, e.g., cloud options. ([DAL](#))
 - Trey ROBY: Firefly's expanding use of VO, including Service Descriptors, Parquet, Healpix & HiPS, TAP, MOCs, SIAv2 ([Applications](#))
- Organization:
 - Tom DONALDSON (TCG VC)
 - Steve GROOM for Operations (Chair)
 - Tess JAFFE for Registry (VC, though Renaud is doing all the work this time)
 - Vandana DESAI (VC CSP)

IAU General Assembly 2024 – Cape Town, South Africa.

**VO Session: Co-organizers: Mark Allen (CDS),
Bruce Berriman (Caltech/IPAC)**

<https://zenodo.org/records/13550169>

Divison B: Parallel Session 3B - Community Engagement , Open Science and the Virtual Observatory

Presentation type Oral Presentations

Session Division B Facilities, Technologies and Data Science

Divison B: Parallel Session 3B - Community Engagement , Open Science and the Virtual Observatory

10.30 – 10.35 Introduction to the Virtual Observatory and the Goals of the Meeting - Mark Allen

10.35 – 10.50 The VO and Education: Data accessibility in developing nations and access by underprivileged groups within developed nations (Priya Shah, Maulana Azad National Urdu University, Hyderabad)

10.50 – 11.05 Enabling Future Breakthroughs in Time-Domain and Multi-Messenger Astronomy (Brad Cenko, NASA/GSFC)

11.05 – 11.20 Big Data and Open Science and Engagement in Radio Astronomy (Russ Taylor, University of Cape Town University of the Western Cape)

11.20 – 11.30 The VO, FAIR Principles and Open Science (Bruce Berriman, Caltech/IPAC)

11:30 - 11:45. Scalable visualization of large distributed data sets enabled by Virtual Observatory standards and tools (Mark Allen, Strasbourg astronomical observatory)



109 Countries Represented



28 African Countries Represented

IAU, Continued

01:30-03:00 Wednesday, 7 August, 2024, Meeting Room 1.61 - 1.62

FM1-4: Harnessing ground-based optical telescopes: an opportunity for emerging astronomy in Africa

Presentation type Oral Presentations
Session FM 1 Harnessing ground-based optical telescopes: an opportunity for emerging astronomy in Africa

FM1-4: Networks of Telescopes and Systems

Chair: Mirjana Povic

10:30 - 10:55 David Buckley - Networking Telescopes: Prospects for Autonomous Follow-up of Discoveries from Future Surveys (invited)

10:55 - 11:10 Judi Provencal - The Whole Earth Telescope and Stellar Seismology

11:10 - 11:25 Grazina Tautvaisiene - Europlanet Telescope Network for promoting international collaboration

11:25 - 11:40 Przemysław Mikołajczyk - Black hole TOM – an automatic tool for photometric time-domain data

11:40 - 11:55 Bruce Berriman - The Benefits of the Virtual Observatory to Underserved Communities

11:55 - 12:15 Yumiko Oass - Japanese collaboration with universities for ground-based optical/infrared observations (invited)

• <https://zenodo.org/records/13381868>

Published August 28, 2024 | Version v1

Presentation Open

The Benefits of the Virtual Observatory to Underserved Communities

Berriman, Bruce (Producer)

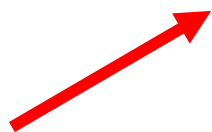
Show affiliations

The Virtual Observatory (VO) is a global ecosystem of interoperating services that connect worldwide data archives. The VO is implemented in all major astronomy archives through common interfaces developed by the 22 members of the International Virtual Observatory Alliance (IVOA). It was founded in 2002, and the latest members, the SKA Observatory and the Kazakhstan Virtual Observatory, joined in 2022. The VO offers access to data on FAIR principles and from its inception has supported Open Science. The VO acts a democratizing influence in astronomy: it provides equal access to worldwide public data sets to under-served communities as to large data centers, and enables international participation in scientific research and education. Thus astronomers from many different communities are positioned to participate in the big science questions emerging in astronomy in the 2020s, such as the interpretation of transient sources that will be measured in forthcoming missions such as Rubin. In addition, the IVOA has signed an MoU with the IAU Office of Astronomy for Development (OAD). Under this MoU, IVOA members took part in "Astronomy from Archival Data" which involved Educational Activities for Under-Graduate and Post-Graduate Students organized by Dr Priya Hasan. The IVOA plans to participate in future such educational events. The presentation describes how new communities may participate in Virtual Observatory science and educational activities. These include practices for developing VO-compliant data centers and archives, and education and training of developers and end users.

Files

Name	Size	Download all
IAU GA Focus Session Berriman copy.pptx md5:d439cc4854289ccc5e865047025056d07	16.4 MB	Download

Citations





NOIRLab - CSDC / Data Lab



- Implemented Python-based VO Publishing Registry
- Initial engagement with Registry WG helped a lot!
- Terraform-based deployment included.
- Templated - you can clone/fork, add your records, and deploy.
- First deployment has Astro Data Lab TAP and SIA services (SCS to follow). Next: add other NOIRLab projects.

- At Data Lab, also integrating Aladin Lite v3 viewer into new Web UI.





NOIRLab - Rubin



- Continuing work on VOTable-as-Parquet, supporting the “HATS” (formerly “hipscat” spatially-sharded-table project).
- Implemented a SIAv2 service layered on top of our Data Butler.
- Supported the P3T effort to define a machine-readable means of defining IVOA protocols.
- Deployed a brand new UWS implementation and switched our services to it.
- Collaborated with STScI on Python vo-models.

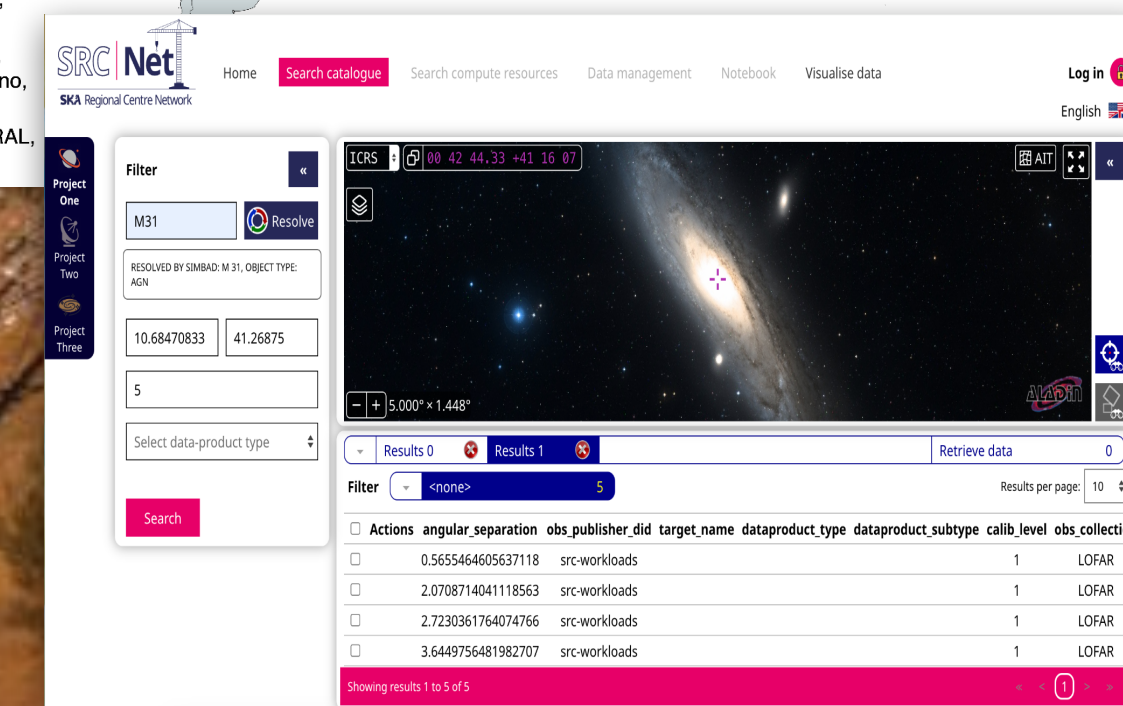
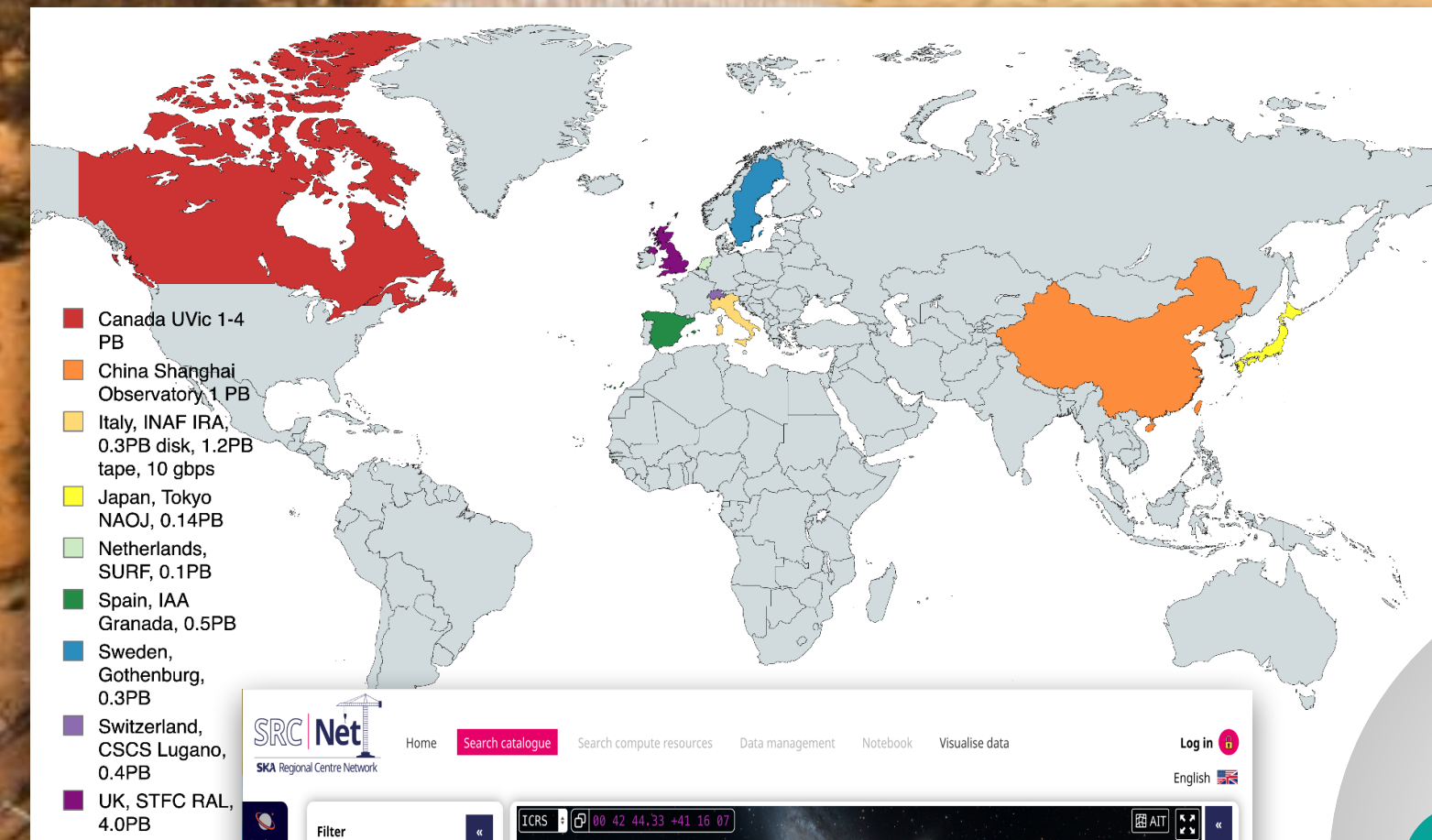
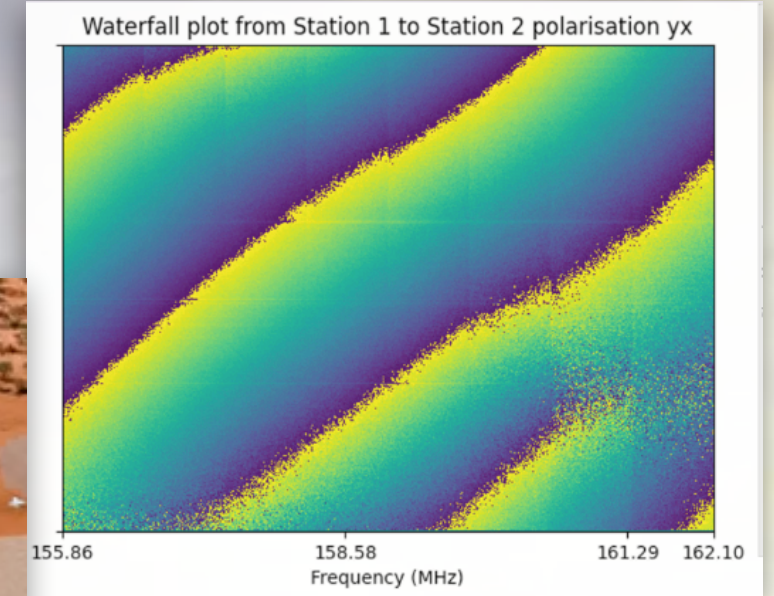
SKAO

Project Status

- **Construction Progress:**
 - Ongoing in both locations
 - First fringes achieved for SKAO-Low (2-station, 512 antennas)
 - Completion expected in 2028
- **Science Data Platform (SRCNet):**
 - Initial SRCNet version (science data platform) in deployment phase
 - Nodes in 8 countries. Includes synthetic & precursor data

IVOA Support

- **Standards & Protocols:**
 - Contributing to ExecutionBroker definition & OpenAPI documentation
 - Supporting Protocols Transition Tiger Team
- **Metadata:**
 - Advancing Radio Astronomy Science Metadata DM
- **Astroquery:**
 - Developing SRC Astroquery module





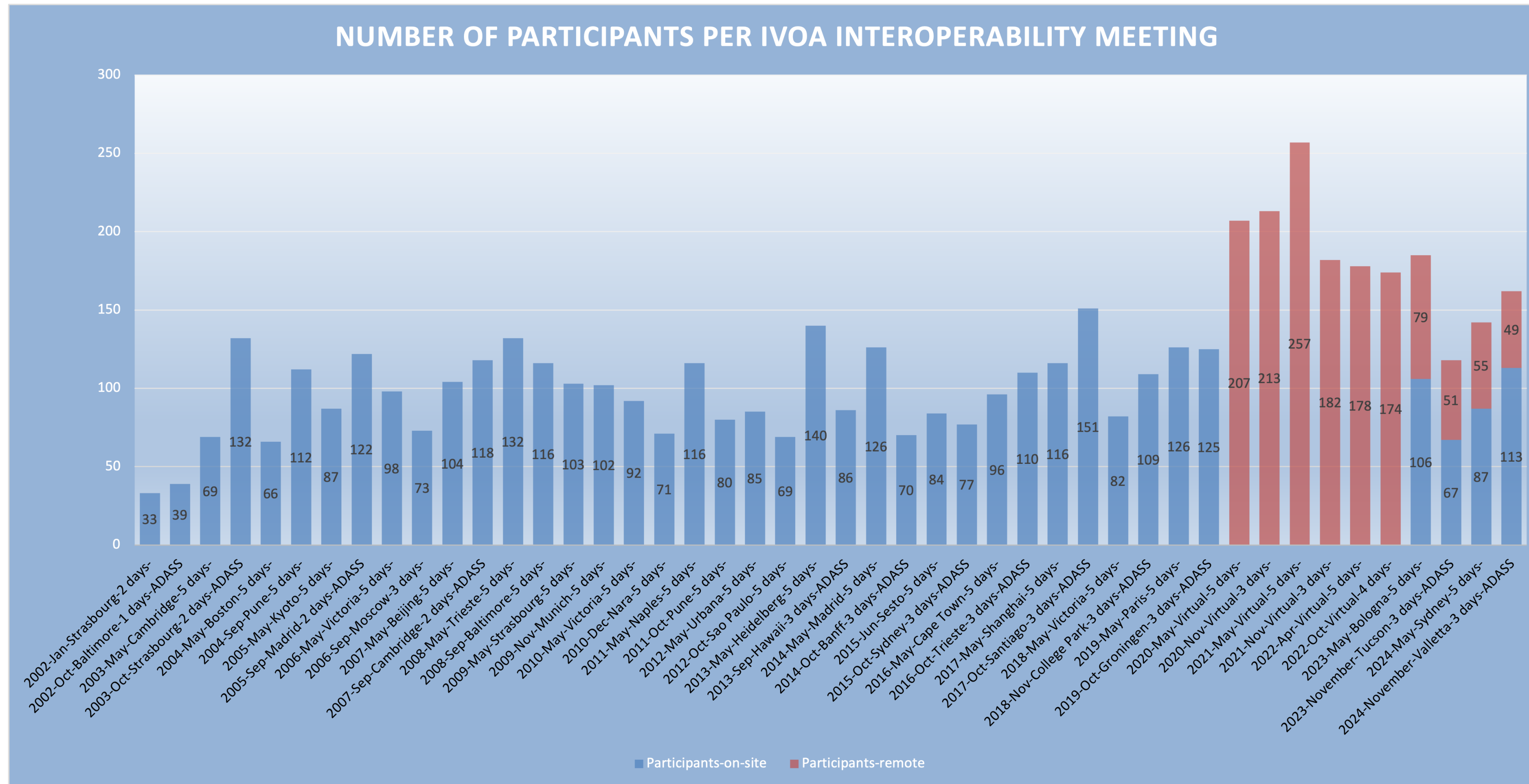
Italian VO contribution



- Contribution to standardization efforts
 - Radio IG & related time domain & semantics (continued)
 - Gravitational waves & MOC: include metadata (e.g. AI driven)
- Dissemination
 - in contact with MAGIC (High Energy) data portal group
 - posters & talks @ INAF level
 - continuously keep up and grow the community
 - Joint effort with Euro-VO partners on the Astro-CC project
- (continued) web assets support
 - web pages rebuilding
 - doc repo restructuring



Meeting attendance



Hybrid meeting

- 113 in person
- 49 online

IVOA Code of Conduct

It is the policy of the IVOA that its members and all participants in IVOA activities should experience an environment that is free from harassment. We want to promote a diverse and inclusive environment with respectful and courteous behaviour and therefore we expect all participants to adhere to the following guidelines:

- Behave professionally. Refrain from harassment in any form, including: sustained disruption of talks or other events; inappropriate physical contact or intimidation; potentially offensive comments related to for example: age, gender, sexual orientation, disability, physical appearance, race, nationality, politics or religion.
- Ensure that all communications are appropriate for a professional audience that may include people with different backgrounds. Sexual or sexist language and imagery are never appropriate.
- Be considerate and respectful to others.
- Critique ideas, not people.

This code of conduct applies to all IVOA community interactions online and offline, including mailing lists, forums, social media, conferences, meetings, associated social events, and one-to-one interactions.

Because of the wide international nature of the IVOA, it is important to realize that behaviour and language that are welcome/acceptable in one particular cultural environment may be unwelcome/offensive in another. Consequently, individuals must use discretion to ensure that their words and actions communicate respect for others.

Anyone who witnesses a deviation from these guidelines is asked to communicate confidentially to the Chair or Vice Chair or any member of the IVOA Executive Committee. The IVOA Executive will take the necessary corrective measures.

We thank you for helping us to make the IVOA a welcoming, diverse and respectful environment for all.

See online here https://www.ivoa.net/members/IVOA_Code_of_Conduct.pdf

Let's get to work

- Thanks to Alessio and the team at University of Malta for supporting this Interop
- Thanks to all our sponsors
- Thanks to Marco and Tom and all WG/IG chairs for putting together the programme
- Looking forward for a fruitful, constructive and interactive meeting!
- Remember it's an hybrid meeting, keep including remote participants!