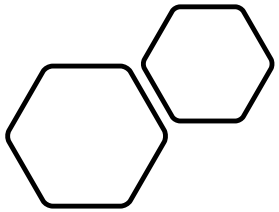
State of the IVOA:
Virtual IVOA Interoperability Meeting, April 2021.

https://www.ivoa.net/

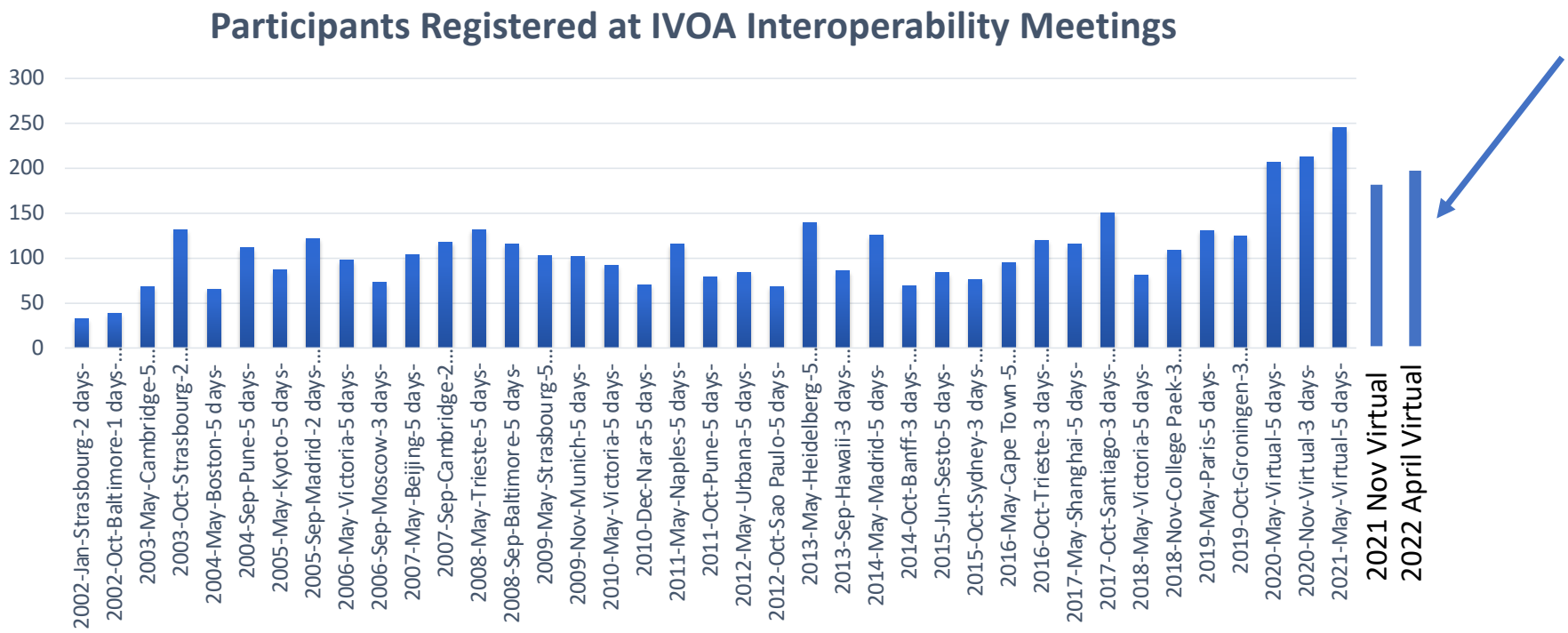


G. Bruce Berriman

Chair, IVOA Executive Committee

(USVOA/NAVO)

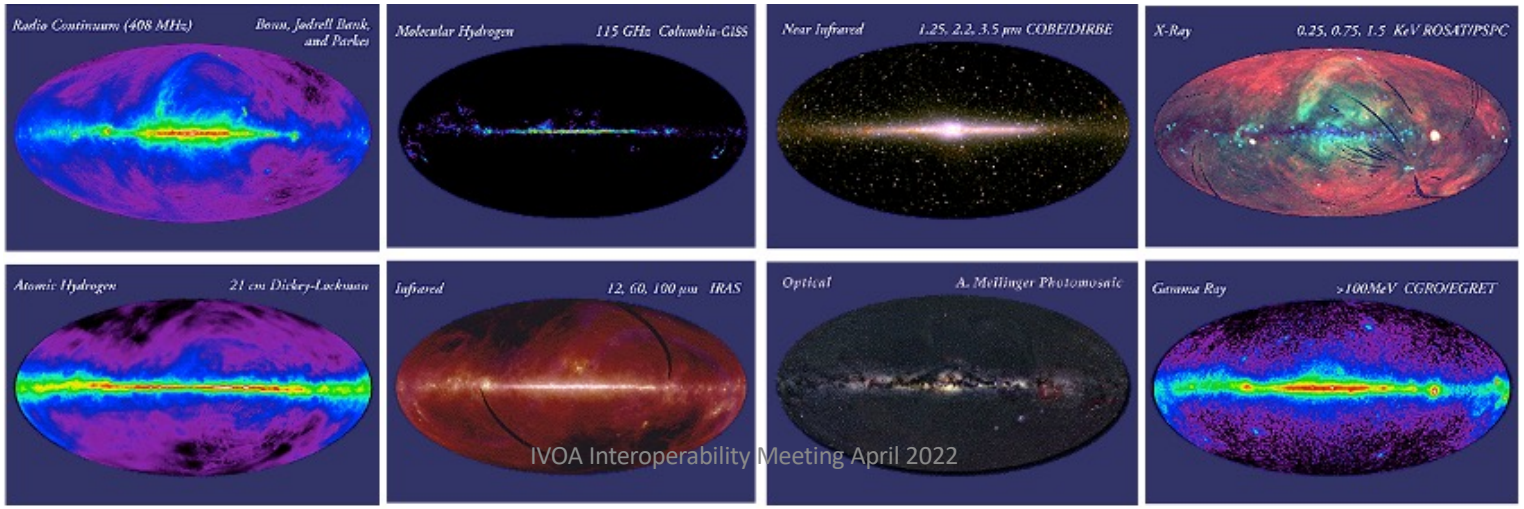
Participation – 178 registered



The Idea of the Virtual Observatory

"A multi-wavelength digital sky that can be searched, visualized, and analyzed in new and innovative ways."

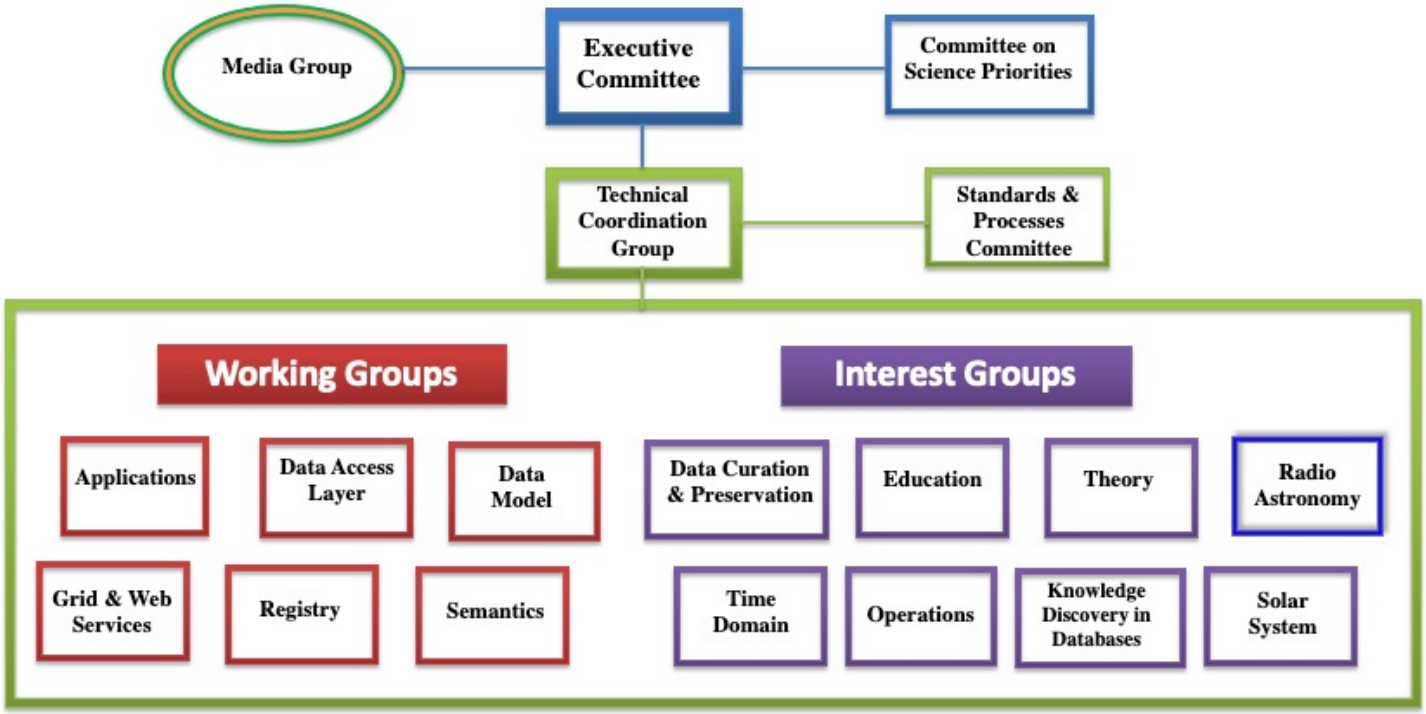
- The VO enables queries to multiple data centers in a seamless and transparent way, provides new powerful analysis and visualization tools within that system, and gives data centers a standard framework for publishing and delivering services using their data.
- Like the World Wide Web, the VO is not a fixed system, but rather a *way of doing things.*



The International Virtual Observatory Alliance

- The IVOA develops the technical standards needed to make the VO possible.
- Created in 2002
- 22 member VO projects
- 6 Working Groups, 8 Interest Groups
- 2 Interoperability meetings per year
  - May
  - Oct/Nov, consecutive with ADASS
- *~ 50 interoperability standards*

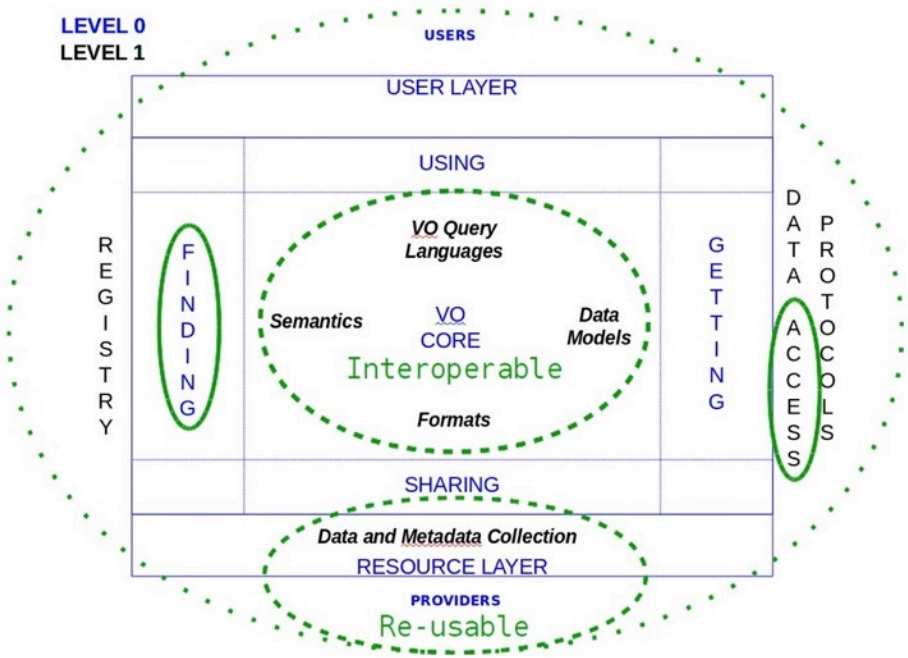
IVOA Organization Chart



The VO Is FAIR!

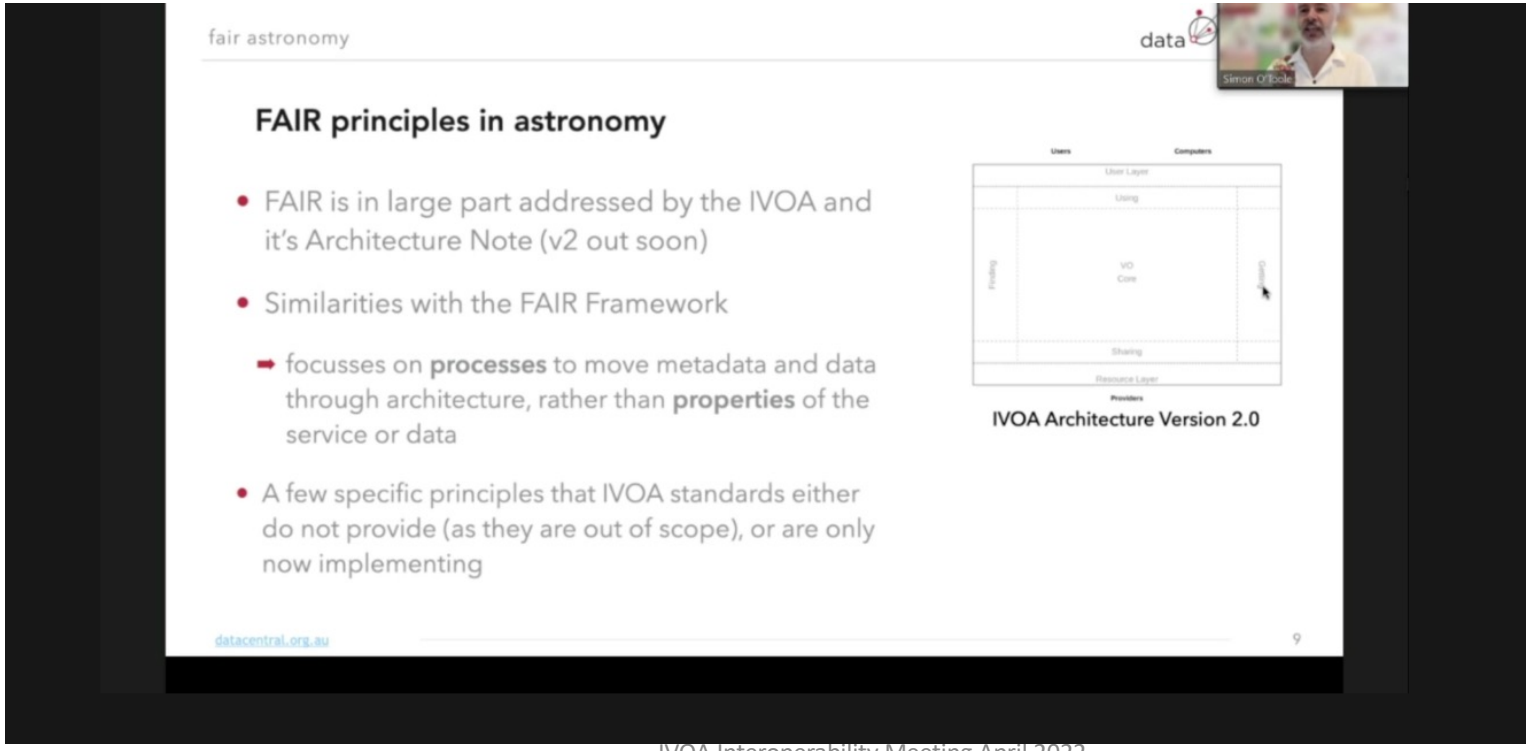
- FAIR Principles make data:

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



*Wilkinson et al 2016 "*The FAIR Guiding Principles for scientific data management and stewardship. doi: 10.1038/sdata.2016.18."

The VO IS FAIR!



This is the bottom part of Simon's head.

See invited talk by Simon O'Toole at ADASS XXXI.

"Make your data VO compliant and you are nearly there."

O'Toole and Tocknell. 2022 https://arxiv.org/abs/2203.10710

It takes more than a pandemic to stop us!

- We have now run four successful virtual meetings …
- … and I am sure we are about to have a fifth.
- Very full program for this meeting
- Includes a Hack-a-thon!
- Full suite of Working Group and Interest Groups activity since November

Programme

Session	Time (UTC)	Elapse time	Session	Notes
Monday Nov 01, 2021				
ZOOM LINK for Monday: sessions complete				
Intro1	20:30 UTC	60 min	Newcomers Intro - IVOA 'How To'	Henrik Heinl/Dave Morris
	21:30	*Break - 30 min*		
Intro2	22:00	60 min	Newcomers Intro - IVOA Examples	Henrik Heinl/Dave Morris
	23:00	*End of Session*		
Session	**Time (UTC)**	**Elapse time**	**Session**	**Notes**
Tuesday Nov 02 2020 @ 06:00 UTC				
ZOOM LINK for Tuesday: meeting ended - recordings available below				
1	06:00 UTC	10 min	Welcome and Logistics	Marco Molinaro
		20 min	State of the IVOA	Bruce Berriman
		10 min	Committee on Science Priorities (CSP) report	Ada Nebot
		20 min	State of the Technical Coordination Group (TCG)	Janet Evans
	07:00 UTC	Break - 10 min		
2		50 min	Charge to WG/IGs	WG/IG Chairs
	08:00	*Break - 5.5 hours*		
3	13:30	60 min	DAL/SSIG	James Dempsey/Gregory Mantelet
	14:30	*Break - 30 min*		
4	15:00	60 min	DM	Laurent Michel/Jesus Salgado
	16:00	*Break - 4.5 hours*		
5	20:30	60 min	CSP	Ada Nebot
	21:30	*Break - 30 min*		
6	22:00	60 min	Apps	Tom Donaldson/Adrian Damian
	23:00	*End of Session*		

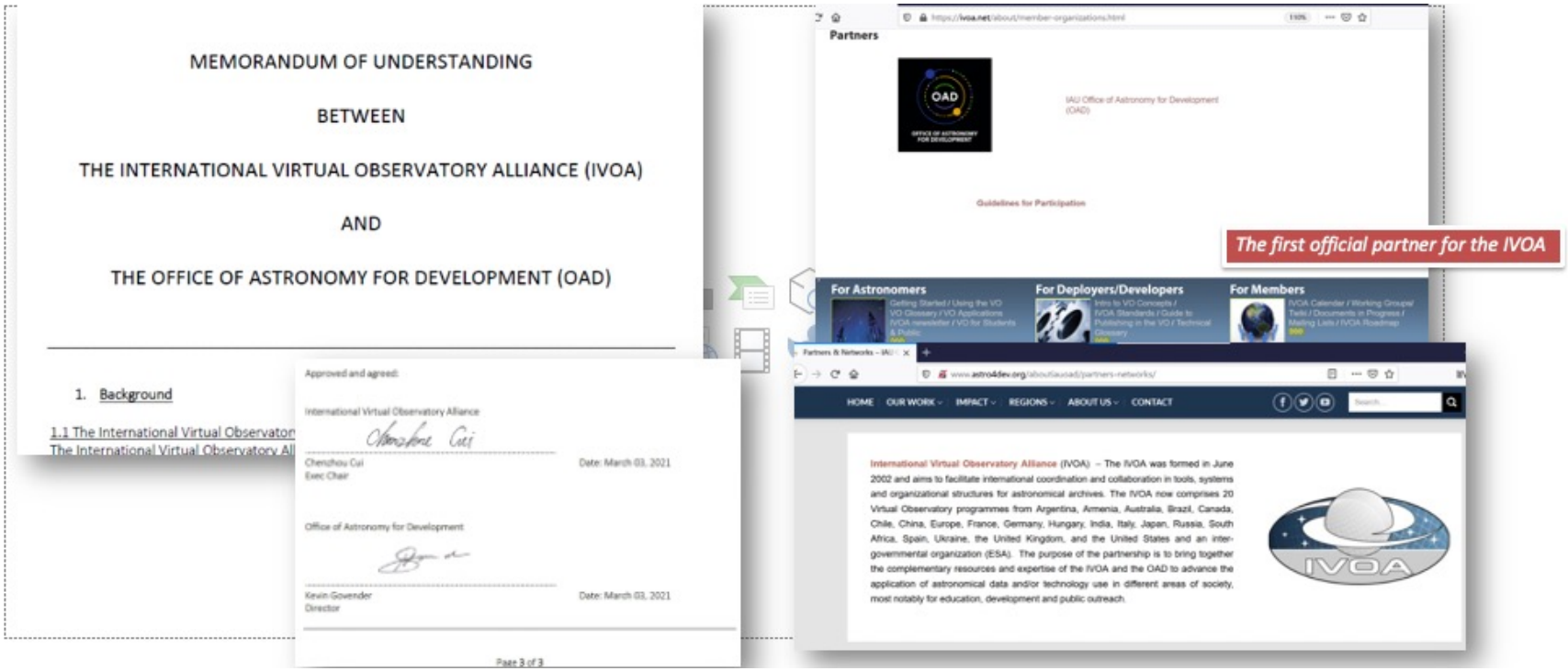
Two Special Sessions - Tomorrow UTC time

- ”Publish Your Data In The VO.”
  - Results of a survey of data providers conducted by the CSP
  - Followed by a panel discussion
  - Tuesday April 26 1500 UTC
- The IVOA and the IAU

The IVOA and the IAU

- The executive committee wishes to improve our standing and visibility within the IAU.
- The IVOA was asked to be a member of the newly approved Division B working group: “Laboratory Astrophysics Data Compilation, Validation and Standardization : from the Laboratory to FAIR usage in the Astronomical Community’’
- The IAU approved the formation of a Functional Working Group on the “Virtual Observatory” within Division B- Facilities, Technologies and Data Science.
- Presentations at “Division B Day” at IAU General Assembly in August 2022: “Science With The VO,” and “FAIR Standards And The IVOA.”

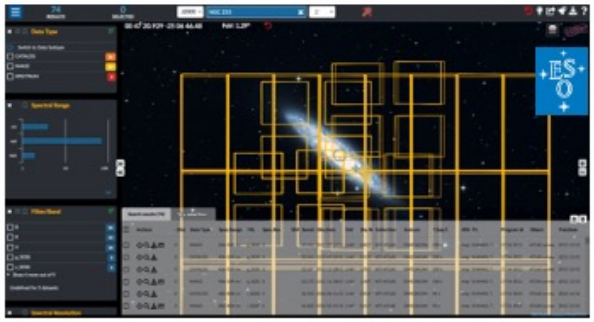
Collaboration between IVOA and IAU OAD



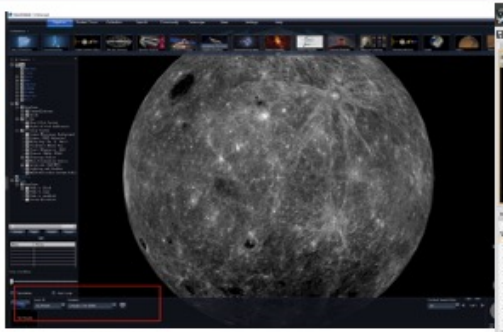
Special Session: IVOA Engagement With the IAU

- Tuesday April 25, 2022, 1303 UTC.
- Aim is to identify our best role in the IAU.
- Speakers:
  - Gabriele Giovannini (IAU Division B President)
  - Marie-Lise Dubernet (IAU Lab Astro WG Chair)
  - Vanessa McBride (IAU OAD)
  - Chenzhou Cui (Division B Data and Documentation President)
- Followed by discussion on IVOA's role within the IAU.

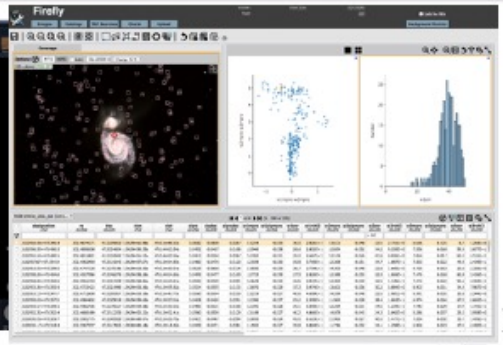
VO embedded in astronomy services



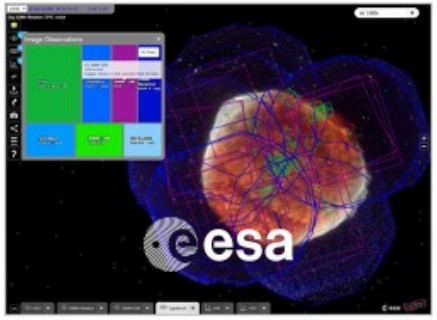
ESO Science Portal



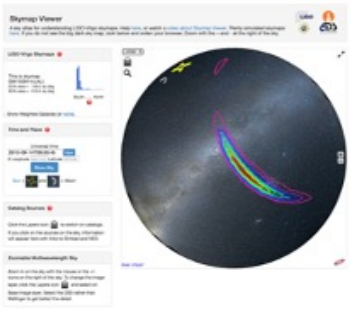
WWT



Firefly
Caltech-IPAC



ESA Sky

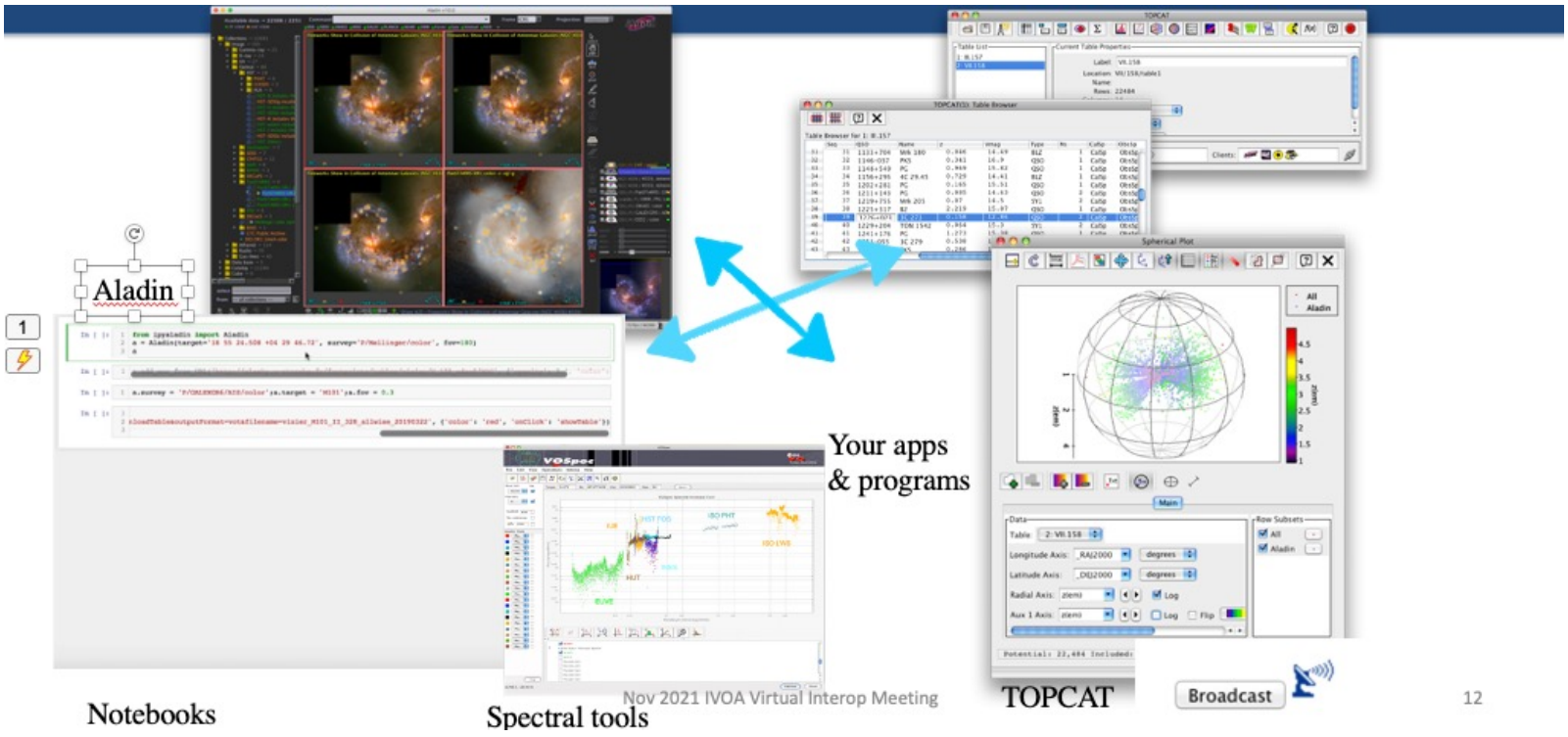


Grav. waves

CDS reference data service

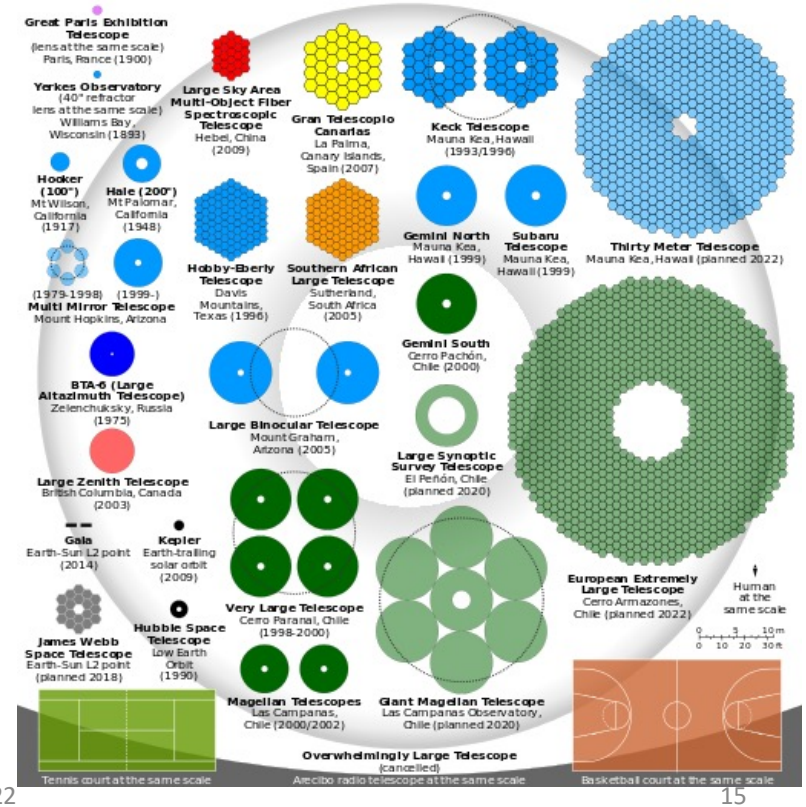
SVO Filter Profile service

Interoperable applications and services



Challenges for the IVOA In 2022 And Beyond

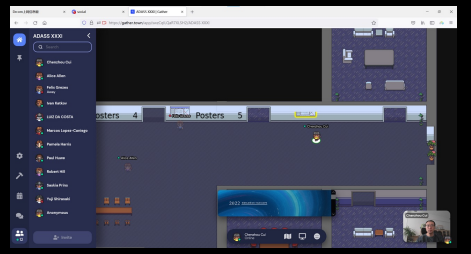
- **PB scale missions will be commissioned!**
- **Big new telescopes!**
- **Support "science platforms" with analysis close to data.**
- Support new data-type adoption, driven by the growth in size and complexity of data sets.
  - Columnar storage formats for large datasets, such as Apache Parquet.
- Support time-domain astronomy and multi-messenger astonomy
- New radio projects.
- Machine learning.



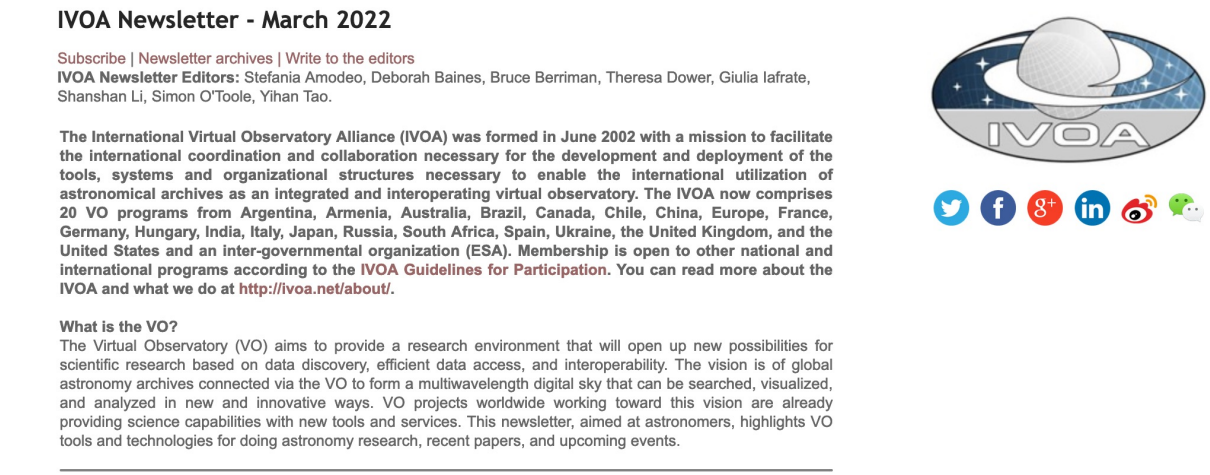
The 1st International WWT Tour Contest launched at ADASS

https://contest.worldwidetelescope.org/

IWTC poster at ADASS gather.town and the venue



March 2022 Edition of IVOA Newsletter



IVOA Newsletter - March 2022

Subscribe | Newsletter archives | Write to the editors
IVOA Newsletter Editors: Stefania Amodeo, Deborah Baines, Bruce Berriman, Theresa Dower, Giulia Iafrate, Shanshan Li, Simon O'Toole, Yihan Tao.

The International Virtual Observatory Alliance (IVOA) was formed in June 2002 with a mission to facilitate the international coordination and collaboration necessary for the development and deployment of the tools, systems and organizational structures necessary to enable the international utilization of astronomical archives as an integrated and interoperating virtual observatory. The IVOA now comprises 20 VO programs from Argentina, Armenia, Australia, Brazil, Canada, Chile, China, Europe, France, Germany, Hungary, India, Italy, Japan, Russia, South Africa, Spain, Ukraine, the United Kingdom, and the United States and an inter-governmental organization (ESA). Membership is open to other national and international programs according to the IVOA Guidelines for Participation. You can read more about the IVOA and what we do at http://ivoa.net/about/.

What is the VO?
The Virtual Observatory (VO) aims to provide a research environment that will open up new possibilities for scientific research based on data discovery, efficient data access, and interoperability. The vision is of global astronomy archives connected via the VO to form a multiwavelength digital sky that can be searched, visualized, and analyzed in new and innovative ways. VO projects worldwide working toward this vision are already providing science capabilities with new tools and services. This newsletter, aimed at astronomers, highlights VO tools and technologies for doing astronomy research, recent papers, and upcoming events.

https://ivoa.net/newsletter/025/index.html

- Giulia Iafrate and Stefania Amodeo are now the lead editors.
- Many thanks to Deborah Baines, who has stepped aside as lead editor after 5 years service.

German Astrophysical Virtual Observatory (GAVO)

- DaCHS 2.5 is out (better validation of UCDs and VOUnits, HDF5 support, and more)
- Facelift for the registry interface in pyVO: https://github.com/astropy/pyvo/pull/289
- LineTAP: Find spectral lines using TAP. Draft spec, first services, and a prototype client in splat.
- RegTAP 1.2 WD coming up: Space/Time/Spectrum discovery and perhaps a GloTS replacement
- Plenty of data publishing-related activity on the national level at the moment: NFDI (~30 communities, we are part of PUNCH), DIG-UM (focus programme for basic physics).

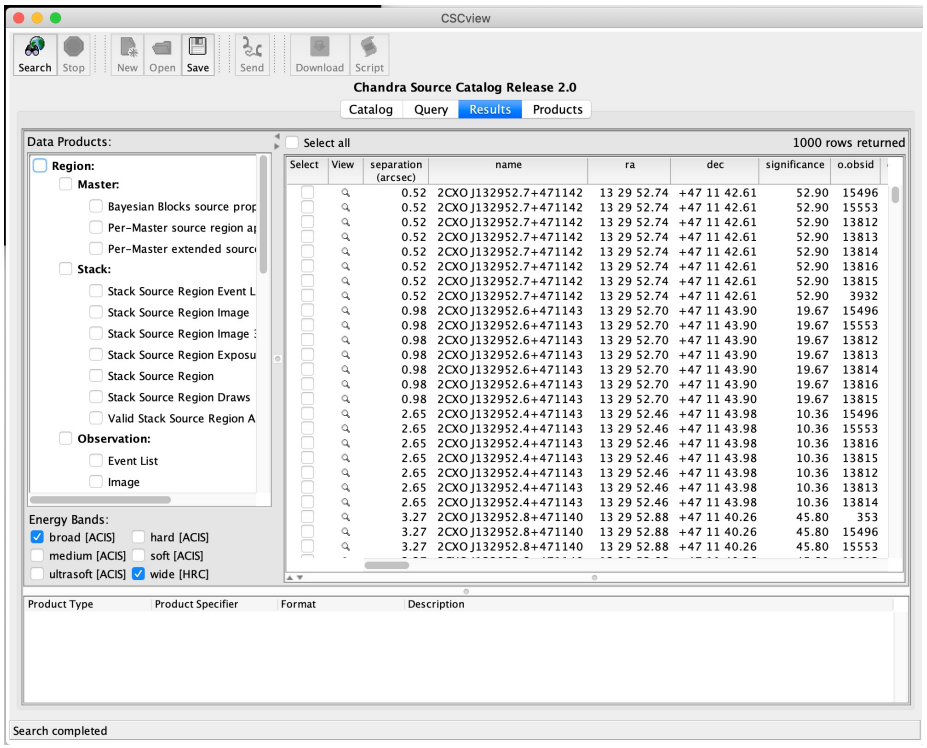
The Chandra Source Catalog - Introduction

- The CSC is the catalog of sources detected in Chandra Imaging observations
- Includes both tabulated *source properties* and ready to use *data products*
- Data *uniformly* processed with the latest calibrations at the time of catalog production
- The current CSC 2.0 release contains 317,167 sources (observations up to 2014)
- The next release CSC 2.1 is expected to contain ~440,000 sources
  (will include public observations up to 2021, production start was 05Apr22)
- Open CSC to Python users through access from Jupyter notebooks
  - Example Python workflows : https://cxc.cfa.harvard.edu/csc/threads/notebooks.html
- CSC 2.0 Cross-match Catalogs with SDSS-DR15
  - https://cxc.cfa.harvard.edu/csc/csc_crossmatches
  - Match probability provided

CSC 2.0 - Interfaces

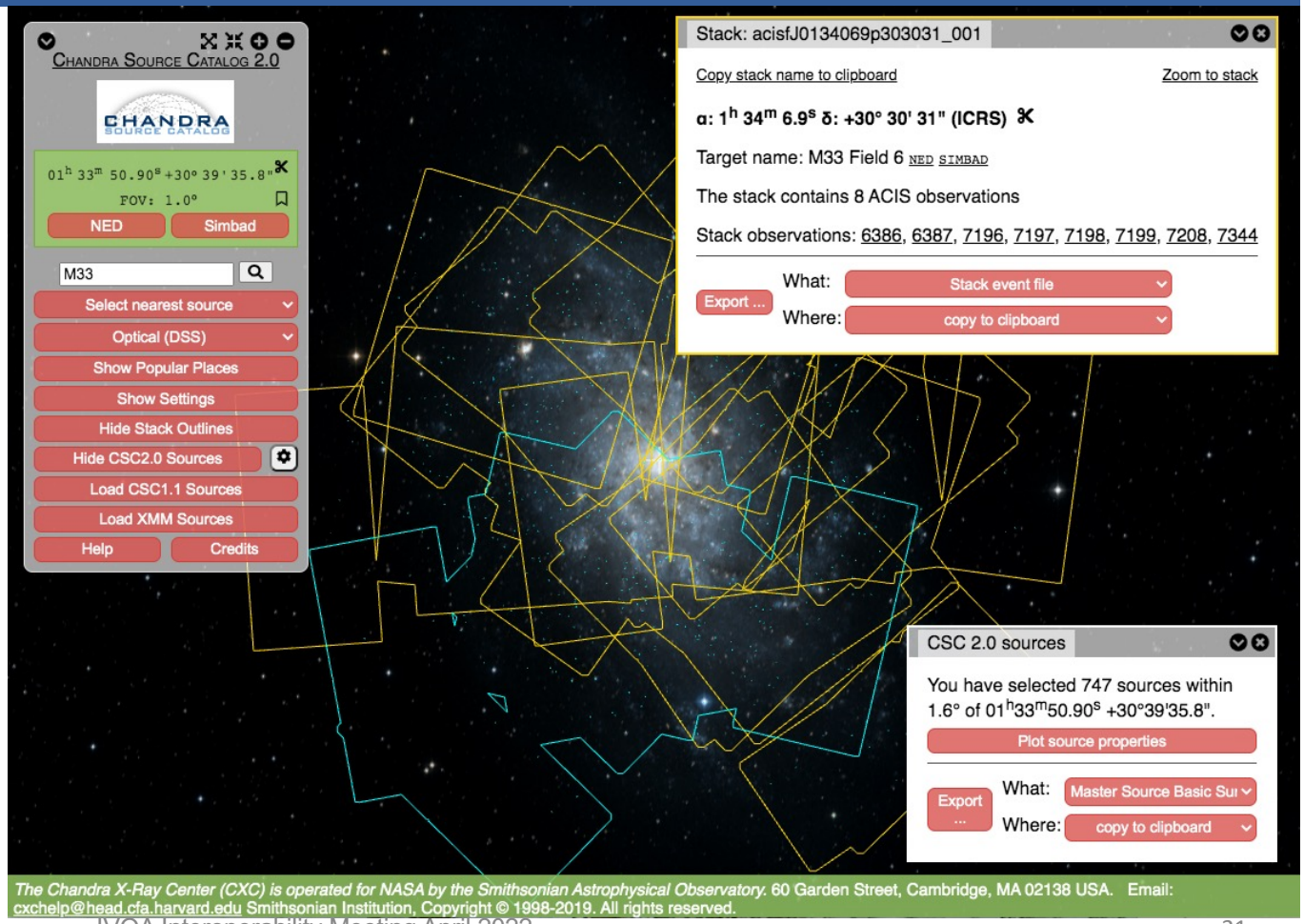
- Compatible with International Virtual Observatory Alliance (IVOA) standards
  - https://cxc.cfa.harvard.edu/csc/threads/all.html
  - Allow standard VO access and Workflows for VO-enabled tools (e.g., TopCAT, DS9)
- CSCview
  - http://cda.cfa.harvard.edu/cscview/
  - Browsing, filtering and extraction of tabular data
  - VO interface allows data visualization and manipulation with VO tools
  - Extraction of source-based data products
- Web Quick View
  - http://cda.cfa.harvard.edu/cscweb/index.do
  - Easy browse for simple queries

CSCview



CSC 2.0 – Visual Interfaces

- WorldWideTelescope
  - https://cxc.cfa.harvard.edu/csc/wwt.html
  - CXC-customized AAS visualization tool
- ESASky
  - https://open.esa.int/
  - Developed by the European Space Agency (ESA)



All-Sky Virtual Observatory News

Data Central and SkyMapper

- Optical Data Centre project funded for 12 months until June 2023
- Data Central Data Aggregation Service extended to query some time-series data like ZTF
- Pipelines as a Web Service (PAWS) nearing completion, should be deployed for testing soon, using 2dF+AAOmega data from AAT; looking at other pipelines
- SkyMapper preparing for Data Release 4 (some delays)

Theoretical Astrophysical Observatory

- Maintenance and user support and testing is the main focus of TAO at the moment

All-Sky Virtual Observatory News

MWA

- Major architecture changes of VO services deployed to make it more maintainable
- Successfully integrated new MWA correlator into workflow
- Migrated storage to an S3-like object store at Pawsey (CEPH)

CASDA

- New data: RACS official catalogue, SWAG-X data
- Migrated storage to an S3-like object store at Pawsey (CEPH)
- Have run tutorials on VO and CASDA tools with around 30 participants
- Started design of an image cutout tool

NAVO in 2022

- New services:
  - MOCs implemented for fast data discovery at IRSA
  - Expanded SSA services including DataLinks at HEASARC for x-ray response matrices, in support of a mission's need for client web tool for spectra quick look analysis.
  - IRSA implemented a Firefly spectral viewer based on Spectral Data Model
  - Cloud-based performance monitoring of NAVO services now integrated into operations and showing impacts of service updates or other changes.
- Development:
  - Workshop on PyVO planned for summer AAS meeting. Long term plan for expanded library of VO-enabled science use cases.
  - Investigating API updates to facilitate cloud data access.
  - Planning closer cross-archive data discovery with ObsTAP
  - Continued expansion of DataLink services.

VO-France

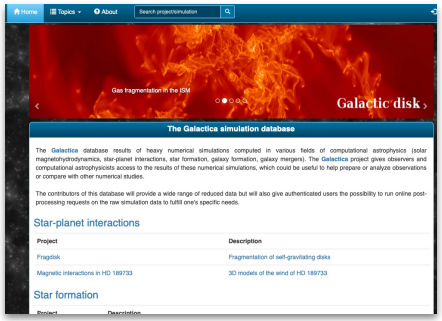
French VO annual meeting took place 2 weeks ago
~ 40 participants happy to see each other in person after 2 years of Covid !

Several hot topics :

- Planetology
  - **CNES** : services **compatible with IVOA standards** and **OGC solutions (Earth Science)**

- **Many evolution of VO-Tools and VO-services** developed in France
  - Aladin / CDS, VESPA, MAGYC, CASSIS, JMMC services, …
    With many VO standards embedded

- **New implementation of VO-Theory standard SimDM** :
  - Galactica



Identification of **needs for new standards and evolution of existing ones** :

- Need for **SLAP2** / **LineTAP**

- **High Energy / Multi-messengers** : Identification of challenges for the interoperability
  Discussions with XMM, Athena, LIGO / VIRGO, AstroColibri

➔ feedbacks at the CSP session

VO-France

European Open Science Cloud

Strong participation of French teams

- Obs. Paris, CNRS, University de Strasbourg are members of EOSC Association
- + ESCAPE European project

Actions : How to integrate VO-services in EOSC ?

CDS highlights

- Multi-Order Coverage maps

- MOC 2.0 standard and reference implementations for Sky+Time indexing of astronomy data.
- MOC lib RUST to be presented at this interop.

- **CDS 50th anniversary**

- several celebrations
- Open Science, VO tools to be highlighted at CDS Booth at **EAS conference July 2022**.

Euro-VO Activities

- EC funded **ESCAPE** Project – now in final phase. **Feb 2019- Jan 2023** https://projectescape.eu)
  - Work package: **CEVO "C**onnecting ESFRI to the **E**OSC via **VO"**
- Euro-VO partners working with large Astronomy, Astroparticle Physics and Solar Physics partners
- EOSC is now in a 2nd phase – EOSC Association established

Funded by the European Union's Horizon 2020 - Grant N° 824064

Euro-VO Status and Highlights

Recent Activities:

- **Hands-on workshop for Data Providers** *(On-line hosted by Heidelberg, 23-26 Nov)*
  https://indico.in2p3.fr/event/23987/
  Examples of publishing to VO, discussion about need to improve 'How to publish to VO' .

- **VO School –** *(On-line hosted by Strasbourg, 22-24 Feb 2022 + 04 March)*
  https://indico.in2p3.fr/event/25225/
  Tutorial materials available for re-use. Participants presented the use of VO tools for their use cases.
  – see IVOA newsletter

- **ESCAPE Technology Forum –** *(On-line hosted by Strasbourg, 15-16 March)*
  https://indico.in2p3.fr/event/26364/

- **Publication** *: A&C paper on GW event follow-ups using MOC – see IVOA newsletter*

Upcoming:

- **ESCAPE final event to be organized in 2nd half 2022**

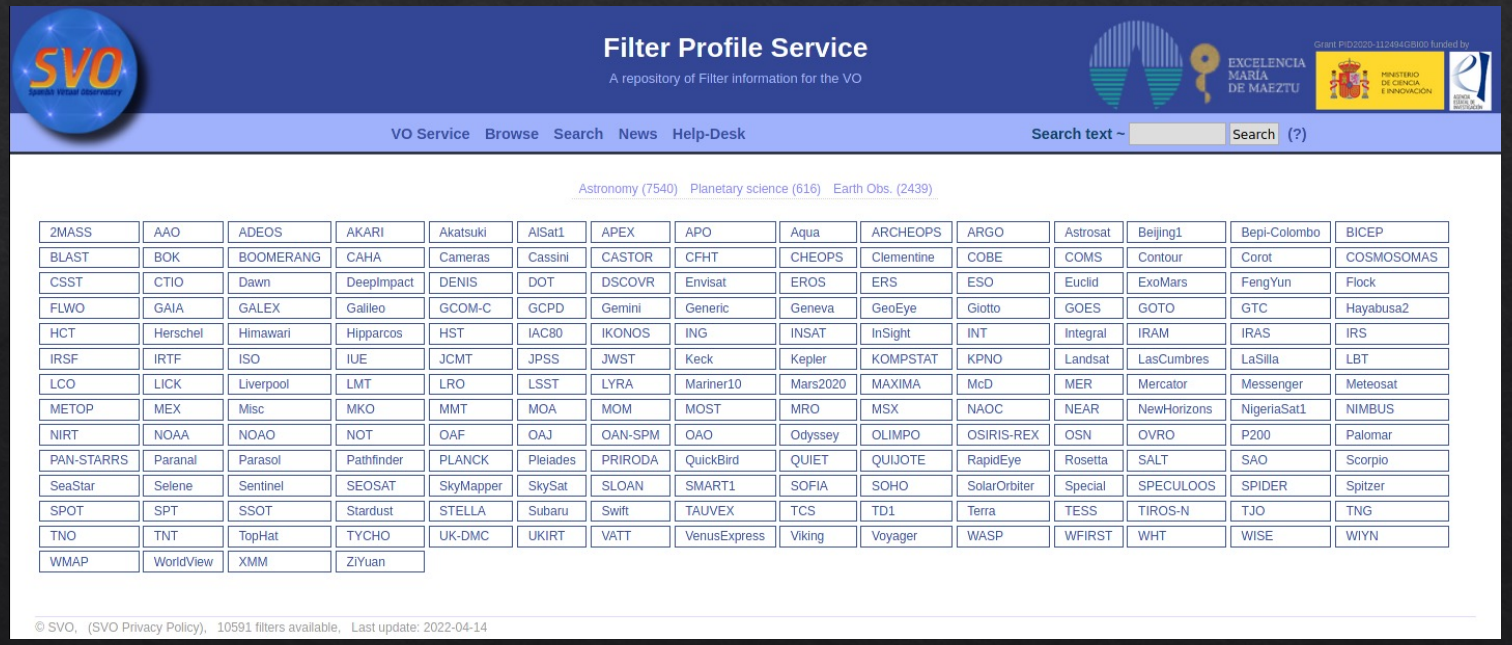
Funded by the European Union's Horizon 2020 - Grant N° 824064

Spanish VO

- Funding secured till the end of 2024
- VO archives: GTC, Calar Alto,…
- VO tools: VOSA, Clusterix, SVO DiscTool, FPS,…
- VO science:
  - BDs, VLM stars, WDs, PNs, AGBs, asteroids,…
  - Training schools.
- Big Data: Automated classification, deep learning.
- Outreach:
  - Pro-am collaborations
  - Citizen science projects.

Spanish VO

- VO tools:
  - Filter Profile Service: > 10 000 photometric filters available.



Filter Profile Service

A repository of Filter information for the VO

VO Service | Browse | Search | News | Help-Desk | Search text ~ | Search | (?)

Astronomy (7540) Planetary science (616) Earth Obs. (2439)

2MASS	AAO	ADEOS	AKARI	Akatsuki	AlSat1	APEX	APO	Aqua	ARCHEOPS	ARGO	Astrosat	Beijing1	Bepi-Colombo	BICEP
BLAST	BOK	BOOMERANG	CAHA	Cameras	Cassini	CASTOR	CFHT	CHEOPS	Clementine	COBE	COMS	Contour	Corot	COSMOSOMAS
CSST	CTIO	Dawn	DeepImpact	DENIS	DOT	DSCOVR	Envisat	EROS	ERS	ESO	Euclid	ExoMars	FengYun	Flock
FLWO	GAIA	GALEX	Galileo	GCOM-C	GCPD	Gemini	Generic	Geneva	GeoEye	Giotto	GOES	GOTO	GTC	Hayabusa2
HCT	Herschel	Himawari	Hipparcos	HST	IAC80	IKONOS	ING	INSAT	InSight	INT	Integral	IRAM	IRAS	IRS
IRSF	IRTF	ISO	IUE	JCMT	JPSS	JWST	Keck	Kepler	KOMPSTAT	KPNO	Landsat	LasCumbres	LaSilla	LBT
LCO	LICK	Liverpool	LMT	LRO	LSST	LYRA	Mariner10	Mars2020	MAXIMA	McD	MER	Mercator	Messenger	Meteosat
METOP	MEX	Misc	MKO	MMT	MOA	MOM	MOST	MRO	MSX	NAOC	NEAR	NewHorizons	NigeriaSat1	NIMBUS
NIRT	NOAA	NOAO	NOT	OAF	OAJ	OAN-SPM	OAO	Odyssey	OLIMPO	OSIRIS-REX	OSN	OVRO	P200	Palomar
PAN-STARRS	Paranal	Parasol	Pathfinder	PLANCK	Pleiades	PRIRODA	QuickBird	QUIET	QUIJOTE	RapidEye	Rosetta	SALT	SAO	Scorpio
SeaStar	Selene	Sentinel	SEOSAT	SkyMapper	SkySat	SLOAN	SMART1	SOFIA	SOHO	SolarOrbiter	Special	SPECULOOS	SPIDER	Spitzer
SPOT	SPT	SSOT	Stardust	STELLA	Subaru	Swift	TAUVEX	TCS	TD1	Terra	TESS	TIROS-N	TJO	TNG
TNO	TNT	TopHat	TYCHO	UK-DMC	UKIRT	VATT	VenusExpress	Viking	Voyager	WASP	WFIRST	WHT	WISE	WIYN
WMAP	WorldView	XMM	ZiYuan											

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Spanish VO

- VO Science:
  - Training schools

XX Escuela SVO – Herramientas del Observatorio Virtual

29 NOVIEMBRE, 2021

VOLVER

XXI Escuela SVO

On-line

15 octubre y 17 de diciembre de 2021

Home - Programme - Registration - Participants - Feedback

European Virtual Observatory Schools

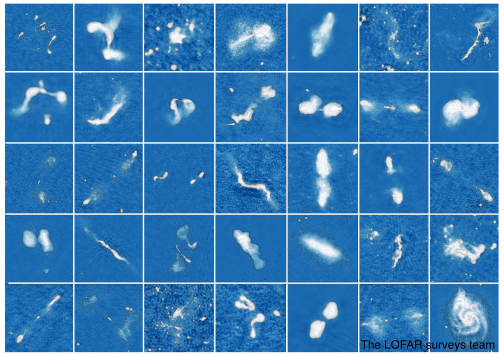
Fran Jiménez-Esteban[1], Mark Allen[2], Stefania Amodeo[2], Miriam Cortés-Contreras[1], Sebastien Derriere[2], Hendrik Heinl[2], Ada Nebot[2], and Enrique Solano[1]

https://arxiv.org/pdf/2112.07370.pdf

Spanish VO

- Feedback:

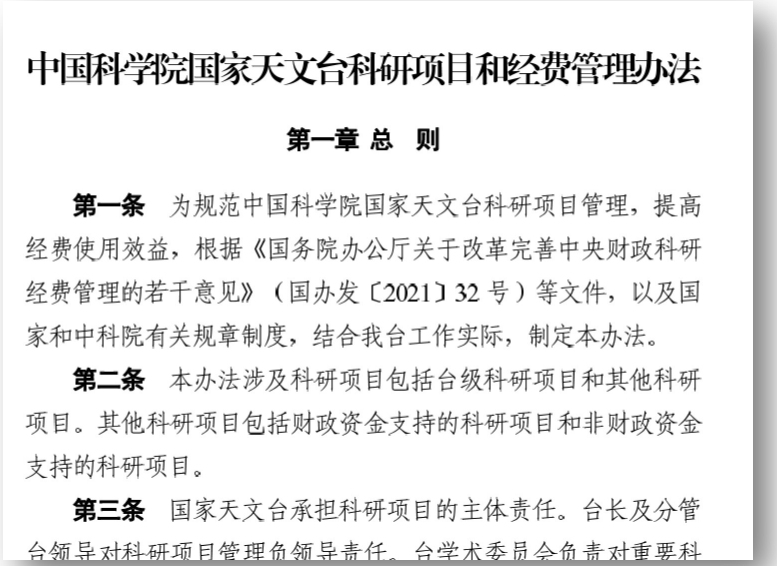
NL VO update april 2022



- Still a bit in the startup phase of the project
  - Setting up material for a colloquium tour
  - Discussing on how to organise ourselves further
- Working in the WG
- Next NLVO meeting to be held in a month from now
  - Coupling the rate to the IVOA interops
- In terms of data releases:
  - LoTSS DR2

Favorable Policy for China-VO from NAOC

The revised “Measures for the Administration of Scientific Research Projects and Funds” of NAOC was released on Mar 14, 2022. According to provisions of the measures, for a NAOC project, *Data Management Plan* should be included in its project proposal, and **data products must be archived** at National Astronomical Data Center (China-VO) before project conclusion.



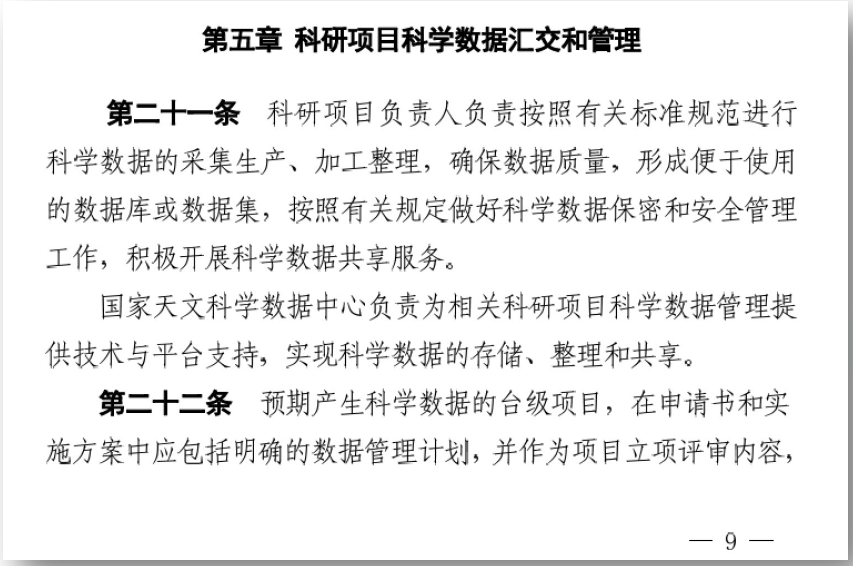
中国科学院国家天文台科研项目和经费管理办法

第一章 总 则

第一条 为规范中国科学院国家天文台科研项目管理，提高经费使用效益，根据《国务院办公厅关于改革完善中央财政科研经费管理的若干意见》（国办发〔2021〕32 号）等文件，以及国家和中科院有关规章制度，结合我台工作实际，制定本办法。

第二条 本办法涉及科研项目包括台级科研项目和其他科研项目。其他科研项目包括财政资金支持的科研项目和非财政资金支持的科研项目。

第三条 国家天文台承担科研项目的主体责任。台长及分管台领导对科研项目管理负领导责任。台学术委员会负责对重要科



第五章 科研项目科学数据汇交和管理

第二十一条 科研项目负责人负责按照有关标准规范进行科学数据的采集生产、加工整理，确保数据质量，形成便于使用的数据库或数据集，按照有关规定做好科学数据保密和安全管理工作，积极开展科学数据共享服务。

国家天文科学数据中心负责为相关科研项目科学数据管理提供技术与平台支持，实现科学数据的存储、整理和共享。

第二十二条 预期产生科学数据的台级项目，在申请书和实施方案中应包括明确的数据管理计划，并作为项目立项评审内容，

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Canadian Virtual Observatory

Standards

- Operation and maintenance of the Registry of Registries
- Deployment of prototype SSO in most CADC/CANFAR services
- Led GMS 1.0 to Recommendation
- Reference implementation of GMS 1.0 service deployed and registered
- WD-DALI-1.2 ~complete
- WD-DataLink-1.1 ~complete

Development

- Delivered Datalink and SODA services for ALMA Science Archive
- Updated CADC and ALMA to use latest Datalink semantics
- Designed and prototyped multi-URI in VOSpace transfer negotiation
- Maintenance of Pyvo

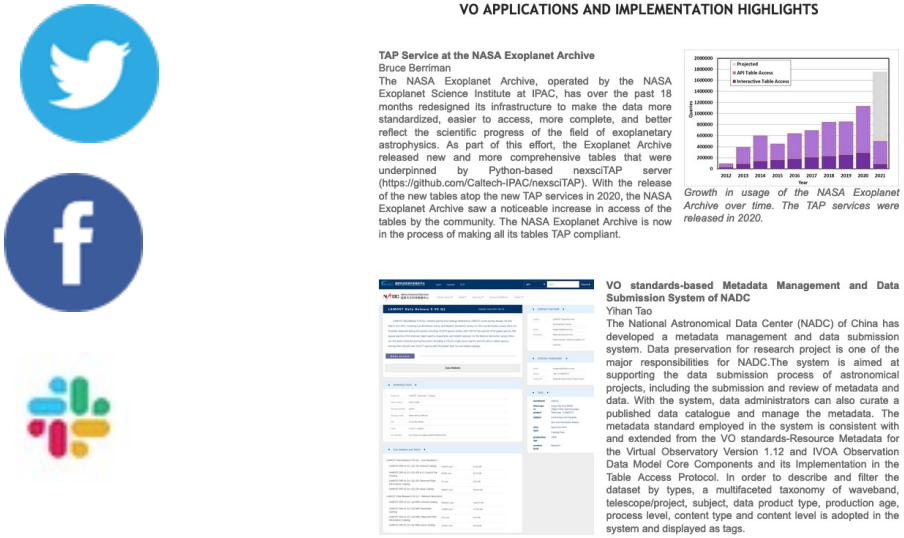
In Memoriam: Doug Tody (1952-2022)

We dedicate this meeting to Doug's memory

Obituary: https://baas.aas.org/pub/2022i034/release/1

Stay connected! …And let's get to work

- IVOA Newsletter. https://www.ivoa.net/newsletter/index.html



VO APPLICATIONS AND IMPLEMENTATION HIGHLIGHTS

TAP Service at the NASA Exoplanet Archive
Bruce Berriman
The NASA Exoplanet Archive, operated by the NASA Exoplanet Science Institute at IPAC, has over the past 18 months redesigned its infrastructure to make the data more standardized, easier to access, more complete, and better reflect the scientific progress of the field of exoplanetary astrophysics. As part of this effort, the Exoplanet Archive released new and more comprehensive tables that were underpinned by Python-based nexsciTAP server (https://github.com/Caltech-IPAC/nexsciTAP). With the release of the new tables atop the new TAP services in 2020, the NASA Exoplanet Archive saw a noticeable increase in access of the tables by the community. The NASA Exoplanet Archive is now in the process of making all its tables TAP compliant.

Growth in usage of the NASA Exoplanet Archive over time. The TAP services were released in 2020.

VO standards-based Metadata Management and Data Submission System of NADC
Yihan Tao
The National Astronomical Data Center (NADC) of China has developed a metadata management and data submission system. Data preservation for research project is one of the major responsibilities for NADC.The system is aimed at supporting the data submission process of astronomical projects, including the submission and review of metadata and data. With the system, data administrators can also curate a published data catalogue and manage the metadata. The metadata standard employed in the system is consistent with and extended from the VO standards-Resource Metadata for the Virtual Observatory Version 1.12 and IVOA Observation Data Model Core Components and its Implementation in the Table Access Protocol. In order to describe and filter the dataset by types, a multifaceted taxonomy of waveband, telescope/project, subject, data product type, production age, process level, content type and content level is adopted in the system and displayed as tags.