State of the IVOA

Virtual IVOA Interop Meeting, Nov. 2020

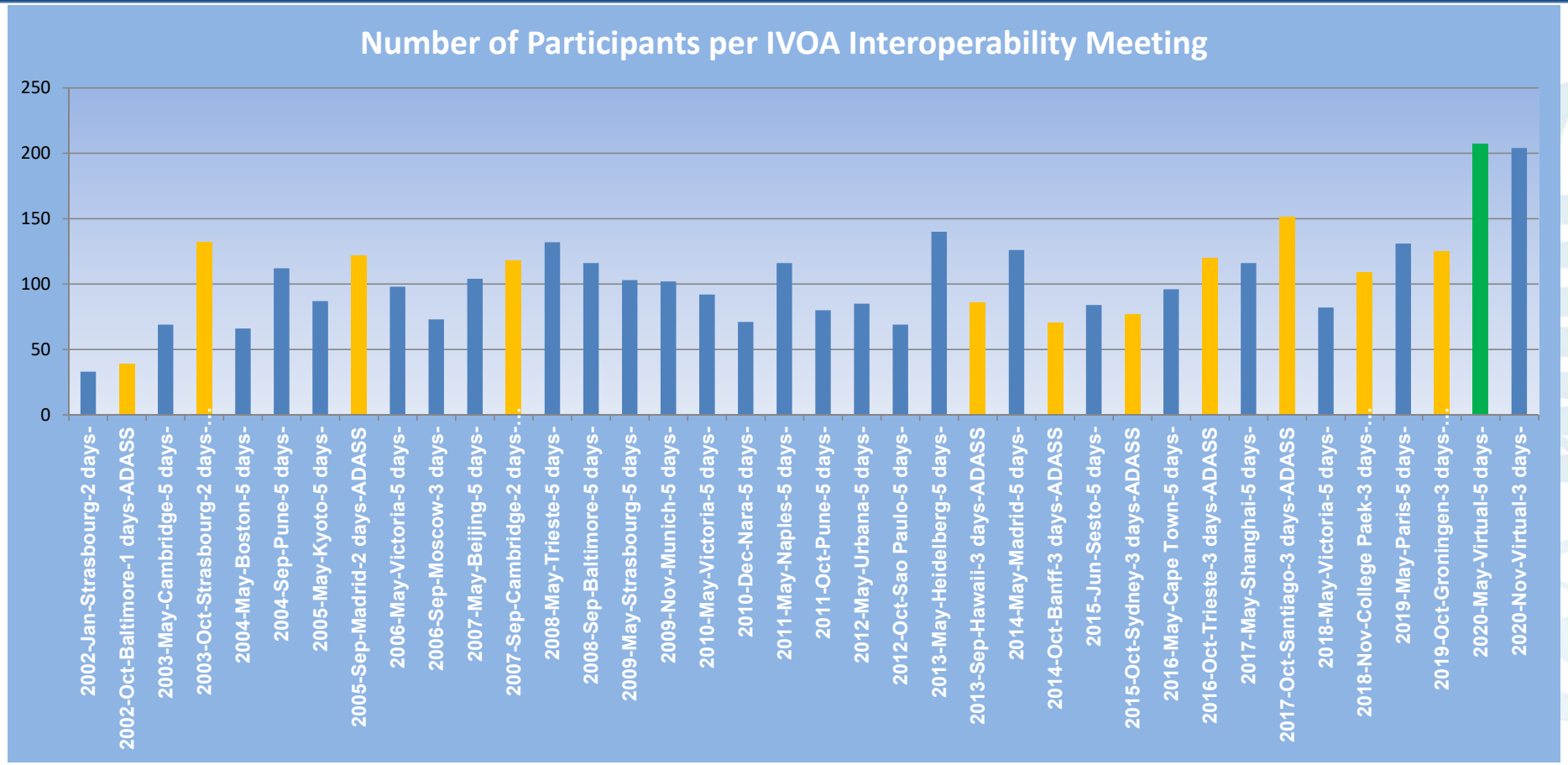
Chenzhou Cui

Chair of the IVOA Executive Committee

Chinese Virtual Observatory

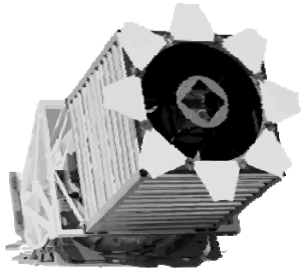
NAOC, CAS

Participation



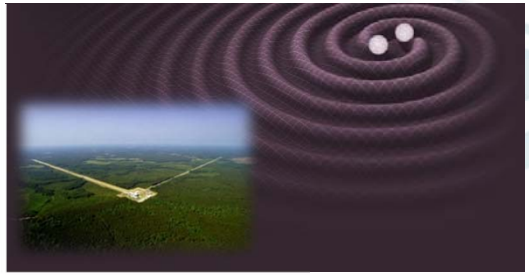
Astronomy: a Data-driven Science

- TBs era
  - 2dFGRS
  - SDSS
  - LAMOST
  - Gaia
- PBs to EBs era
  - FAST (in science operation since 2020)
  - SKA
  - Vera Rubin Observatory LSST
  - Euclid
  - …
- Astronomy is entering a new era of big data where the data sets are too large to download and analyze using users' own facilities.









The Idea of Virtual Observatory

Vision of the VO:

- The Web is *transparent*. The goal of the Virtual Observatory is to achieve the same feeling for astronomical data - that it is all available to explore in a single transparent system.
- Astronomical datasets, tools, services should work seamlessly together.
- The VO allows astronomers to interrogate 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.*

Virtual Observatory (VO) is a data-intensively online astronomical research and education environment, taking advantages of advanced information technologies to achieve seamless, global access to astronomical information.

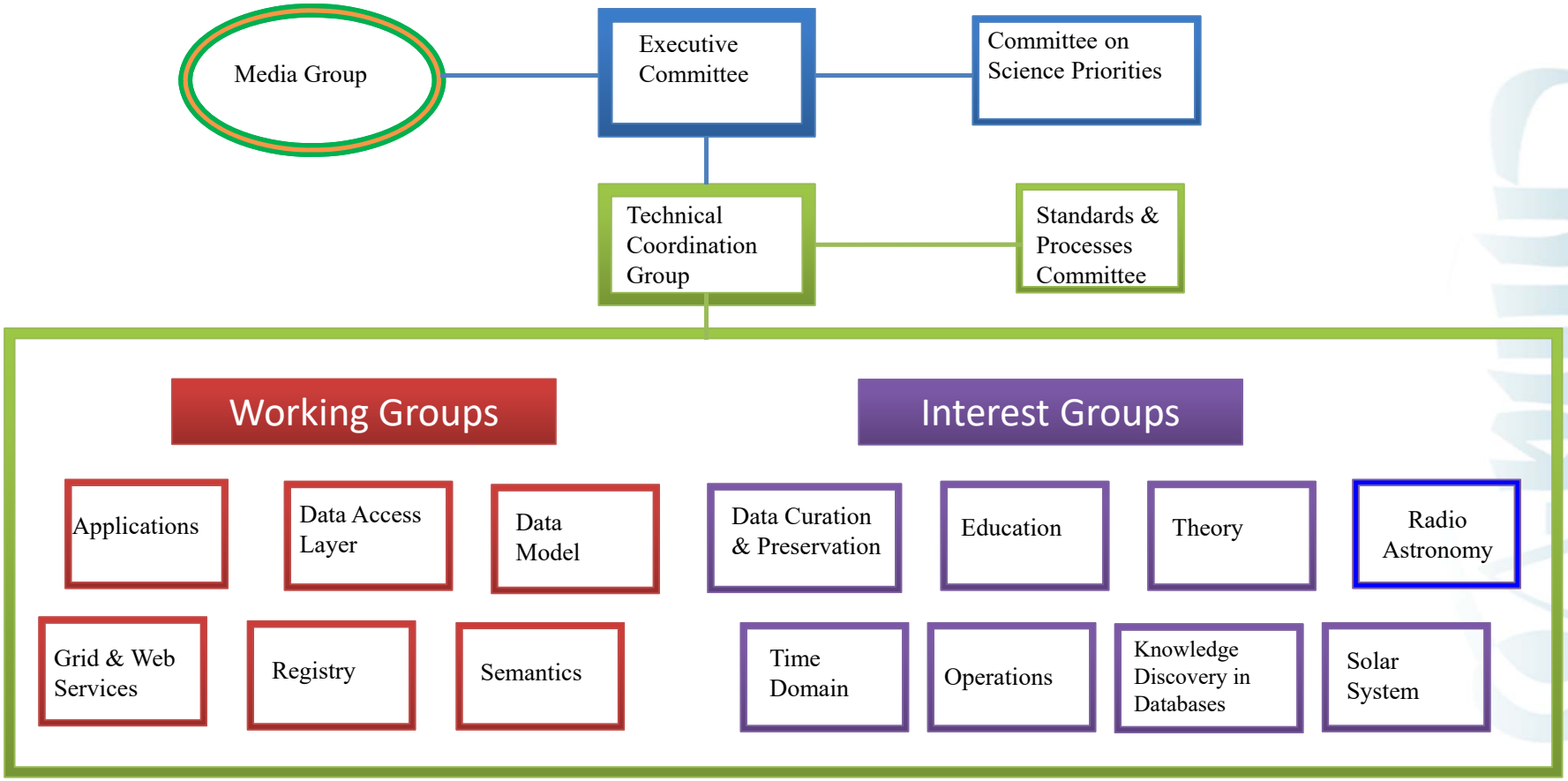
-- my words

International Virtual Observatory Alliance

- An organisation that debates and agrees the technical standards that are needed to make the VO possible, A focal point for VO aspirations, a framework for discussing and sharing VO ideas and technology.

- Created in 2002
- 21 member VO projects
  - Netherlands shows strong interests
  - Thailand-VO is under preparation
- 6 Working Groups, 8 Interest Groups
- 2 Interoperability meetings per year
  - May
  - Oct/Nov with ADASS
- *~ 46 interoperability standards*

IVOA Organization Chart



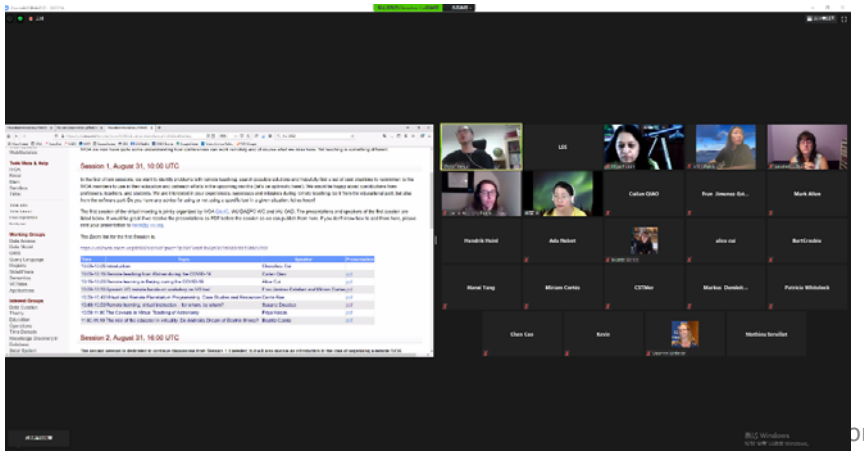
WG/IG Chair and Vice Chair renew

- Solar System IG
  - Chair: Baptiste Cecconi (1 yr ext. to May 2021)

We are working hard

even in the very special year

- TCG, 10 telecons
- Exec, 6 telecons
- WGs, dozens of VMs
- + Special workshops

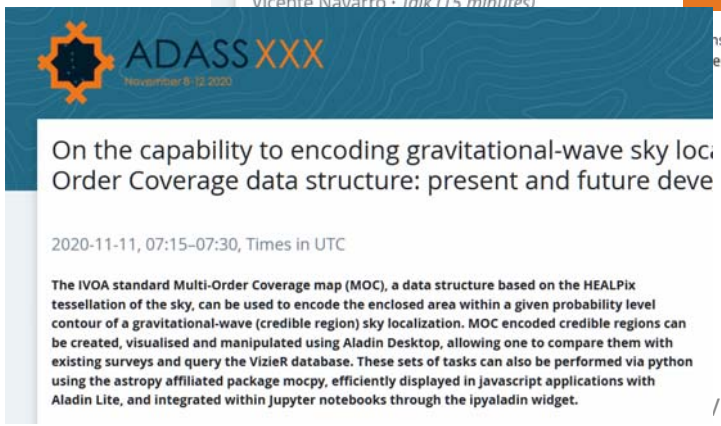


2020				
Date	**Event**	**Host**	**Location**	**Further Info**
Feb 11	TCG Telecon	Telecon	20:00 UTC	
Feb 18	Exec Telecon	Telecon	10 am Eastern	
Mar 24	Exec Telecon	Telecon	15:00 UTC	
Apr 07	TCG Telecon	Telecon	15:00 UTC	
Apr 16	TCG Telecon	Telecon	20:00 UTC	
Apr 21	Exec Telecon	Telecon	15:00 UTC	
3 May-8 May	Interoperability Meeting		Sydney (Australia)	Meeting Page *Replaced by the following virtu COVID-19 outbreak*
4 May - 8 May	Virtual Interoperability Meeting		Online	Meeting Page, Program Page
May 14	TCG telecon	Telecon	15:00 UTC	
Jun 11	TCG telecon	Telecon	20:00 UTC	
Jun 23	Exec Telecon	Telecon	15:00 UTC	
Aug 27	TCG Telecon	Telecon	15:00 UTC	
Sep 15	Exec Telecon (TM93)	Telecon	14:30 UTC	
Sep 22	TCG Telecon	Telecon	20:00 UTC	
Oct 08	TCG Telecon	Telecon	15:00 UTC	
Oct 27	Exec Telecon (TM94)	Telecon	14:00 UTC	
Oct 29	TCG Telecon	Telecon	20:00 UTC	
17 Nov - 19 Nov	Interoperability Meeting		Granada (Spain)	Meeting Page *Replaced by the following virtu COVID-19 outbreak*
17 Nov - 19 Nov	Virtual Interoperability Meeting		Online	Meeting Page, Program Page

Heavily involved in the ADASS XXX

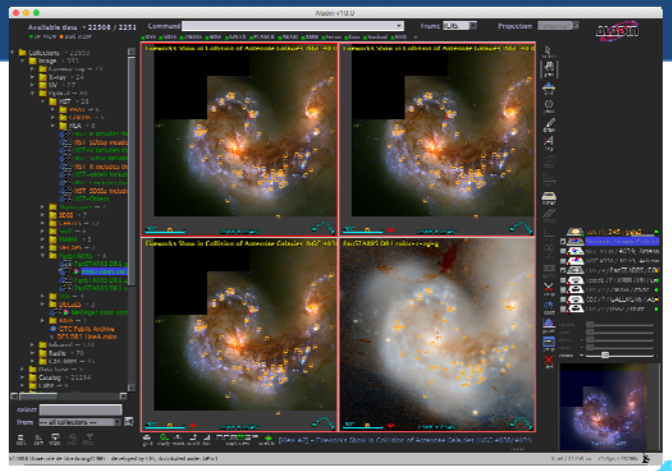
IVOA related contributions

- 5+ talks
- 18+ posters
- 3+ BoFs

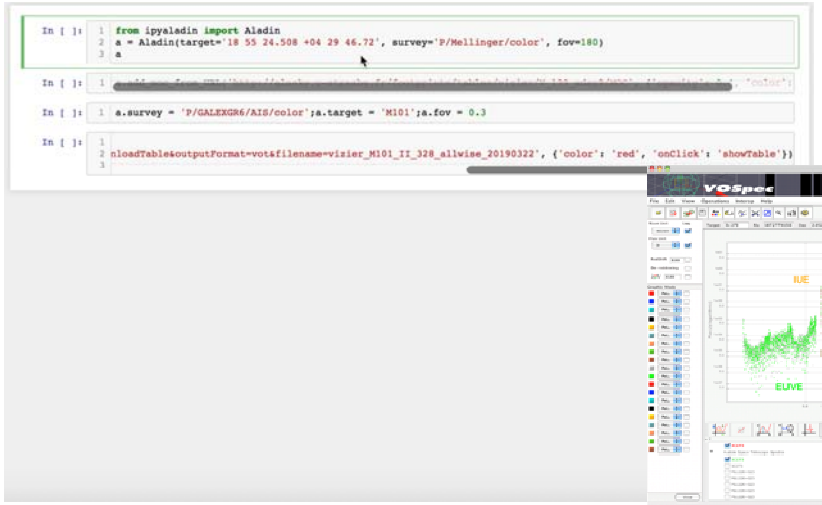


/irtual Meeting 2020

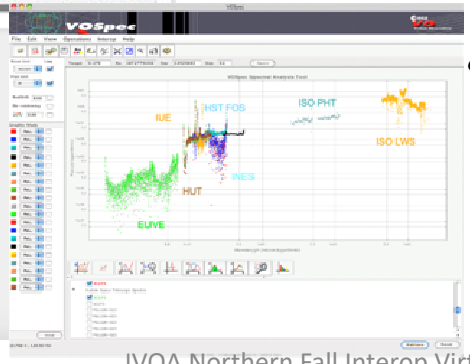
Interoperable applications and services



Aladin

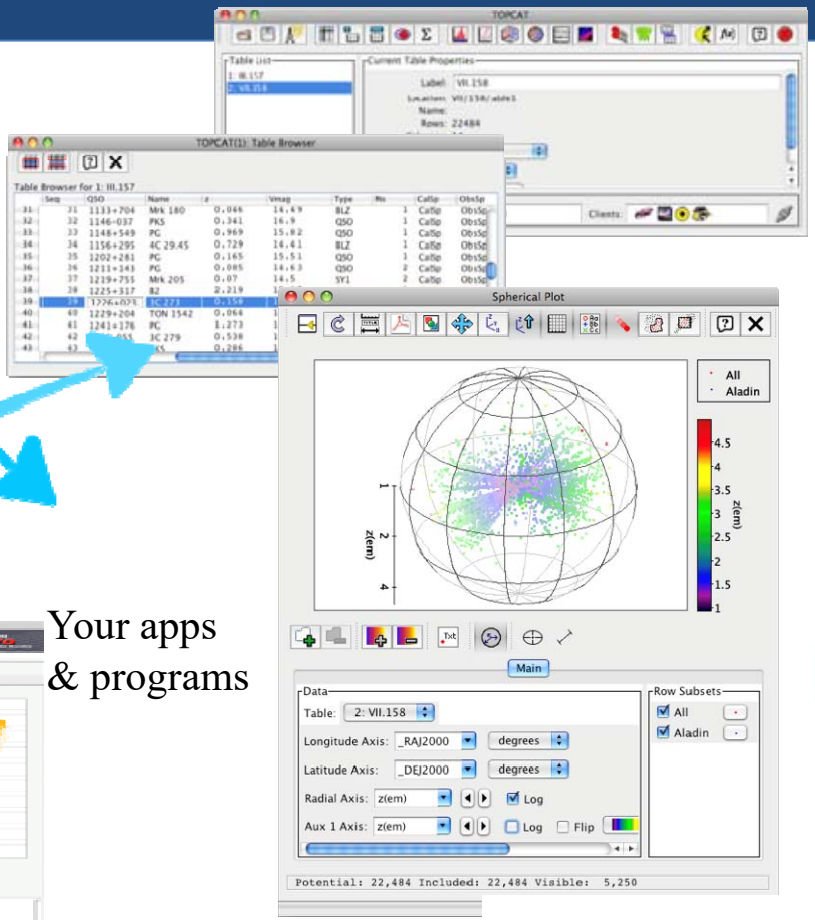


Notebooks



Spectral tools

Your apps & programs

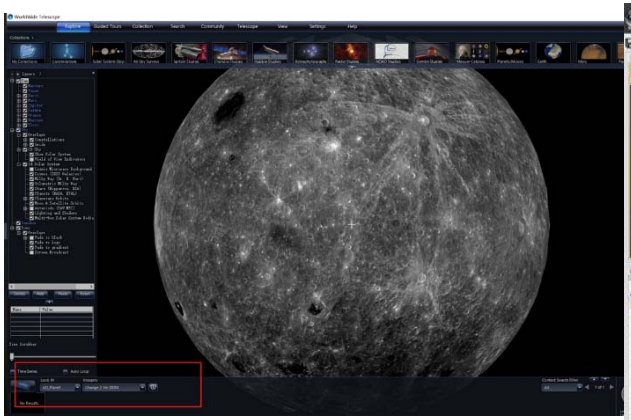


TOPCAT

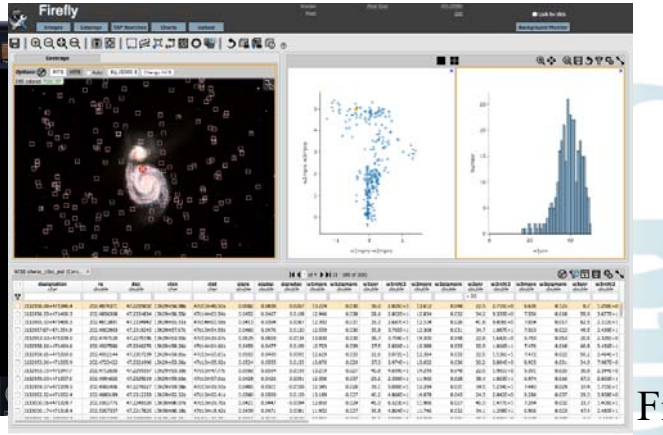
Broadcast

VO embedded in astronomy services

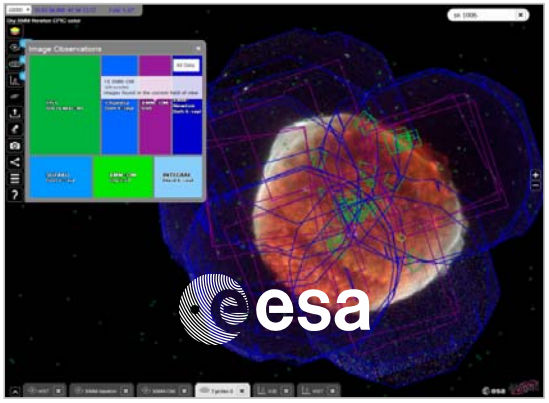
ESO Science Portal



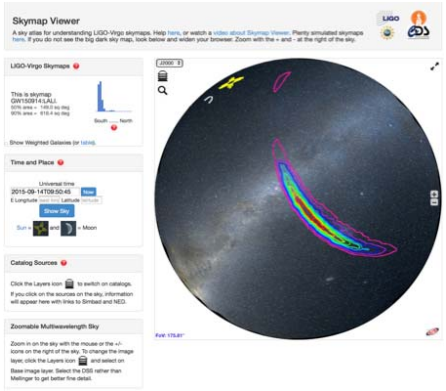
WWT



Firefly
Caltech-IPAC



ESA Sky



Grav. waves

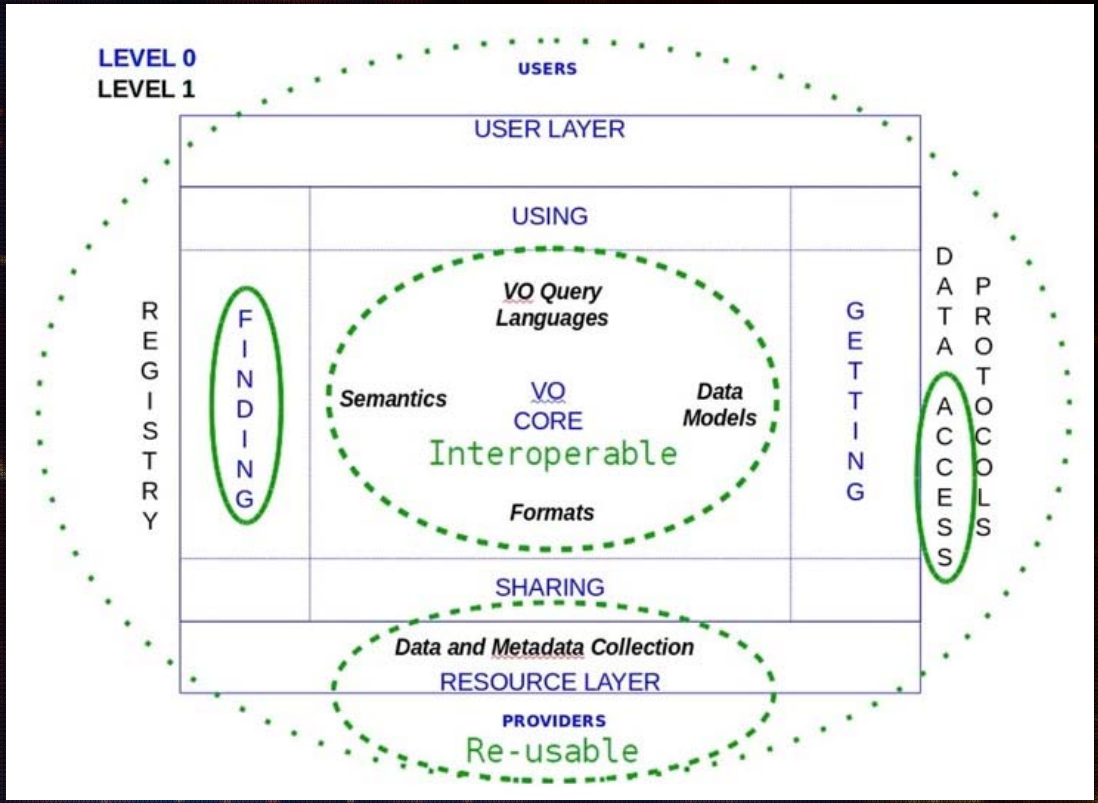
CDS reference data service

SVO Filter Profile service

VO is FAIR

Making data:

Findable
Accessible
Interoperable
Reusable



These online VO data services and tools laid a solid groundwork for the science platform idea.

Credit: X-ray: NASA/CXC/CfA/R. Tullmann et al.; Optical: NASA/AURA/STScI

VO-Driven Science Platforms

- The amount of astronomy data will increase greatly in the near future. Science platforms are being developed to allow researchers to efficiently analyze big data sets. These science platforms enable analysis close to the data, support online data mining and machine learning.
- Most science platforms in astronomy employ a similar architecture and technologies to provide an interactive data analysis environment. Basing on a Cloud computing platform, JupyterHub with JupyterLab are used as an interface for exploratory data mining and analysis. The interactive environment is generally deployed using container techniques (e.g., docker).

Open Science Cloud Platforms

- European Open Science Cloud
  - It is a trusted system providing seamless access to data and interoperable services. It supports the whole research data cycle, from discovery and mining to storage, management, analysis and re-use across borders and disciplines.
- **African Open Science Platform**
  - The *African Open Science Platform* initiative (AOSP), funded by the South African Department of Science and Technology (DST) through the National Research Foundation (NRF), and implemented and managed by the Academy of Science of South Africa (ASSAf), is a pan-African project for Africa by Africa. Direction is provided by CODATA (ISC).
- GÉANT
  - GÉANT is a fundamental element of Europe's e-infrastructure, delivering the pan-European GÉANT network for scientific excellence, research, education and innovation.
- Australian Research Data Commons (ARDC)
  - The **ARDC** is a transformational, sector-wide initiative, working with sector, government, and industry partners to build a coherent national and collaborative research data commons. This will deliver a world-leading data advantage, facilitate innovation, foster collaboration and enhance research translation.
- Global Open Science Cloud
  - The mission of GOSC is to connect different international, national and regional open science clouds and platforms to create a global digital environment for borderless research and innovation.
- Pangeo, …

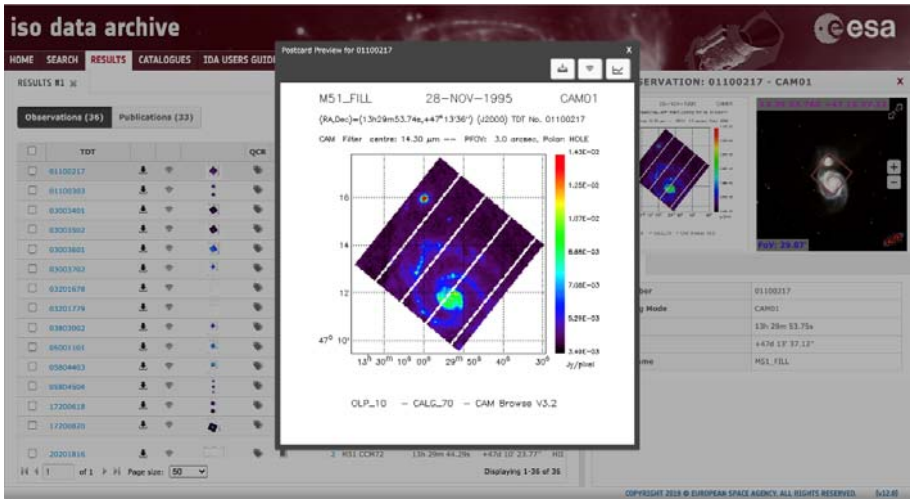
Challenges and Future Trends

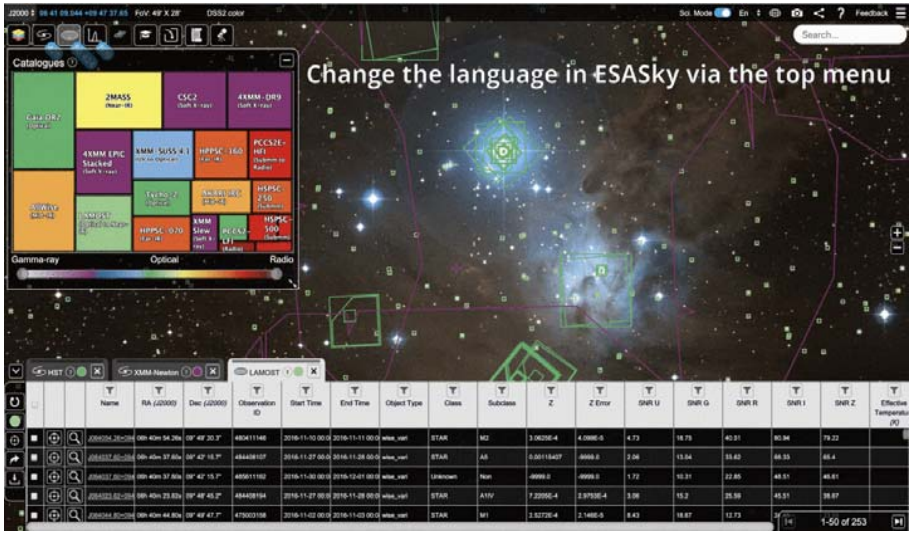
- Challenges
  - Single Sign-On (SSO) and interconnection among different science platforms: authentication and authorization
- Trends
  - Hybrid networks: Internet, mobile Internet, Satellite Internet, 5G, etc.
  - Really big data: time-domain, multi-messenger astronomy
  - AI: Data mining and machine learning
  - Citizen science: Inclusion, Diversity and Equity

Highlights from IVOA Members

ESA-VO Activities

- TAP 1.1 implementation ready, archives currently being updated
- Gaia: New DataLink contents for eDR3 (Mcmc, RVS spectra, Xp mean spectra & Xp sampled mean spectra)
- New ISO archive released (with ADQL, ObsTAP, SAMP, SIAP, SSAP, TAP+): https://archives.esac.esa.int/nida
- ESASky: Access to External TAPs (from ESO, CADC & MAST). Chinese version in collaboration with China-VO
- Euclid: Integration of TAP+, Datalink (for 1D spectra), SIAV2 (Euclid images based on ObsCore view) & ObsCore v1.1 to expose Euclid Observation DM
- ObsCore implemented for HST, JWST, Euclid & INTEGRAL TAP services
- New XMM-Newton module published in Astroquery
- INTEGRAL ObsLocTAP service registration in the IVOA and ObsLocTAP in RFC phase



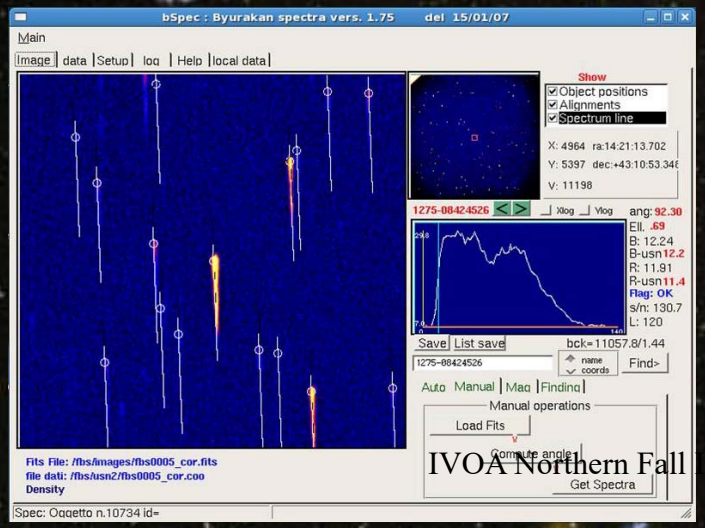


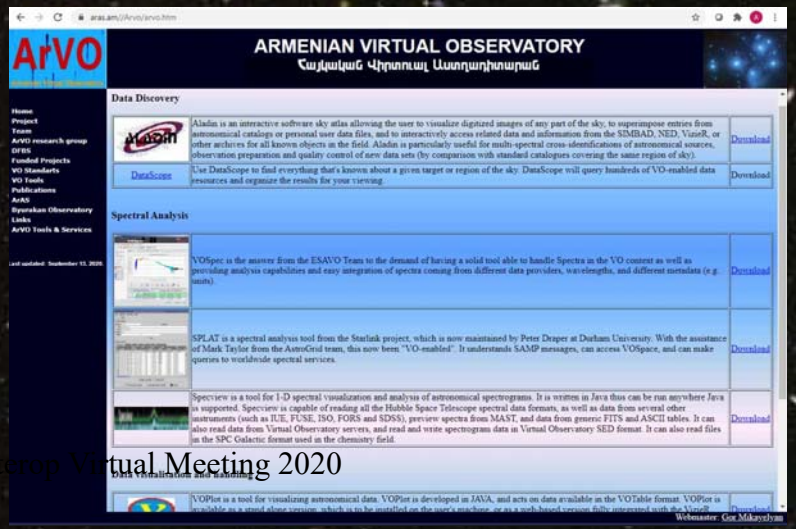
ArVO – Armenian Virtual Observatory

ArVO Team:

- Areg Mickaelian (Project Manager, BAO)
- Hrach Astsatryan (Technical Manager, IIAP)
- Aram Knyazyan (IIAP)
- Gor Mikayelyan (BAO)
- Daniel Baghdasaryan (BAO)

Collaborations: ARI, Heidelberg, LAMOST, France

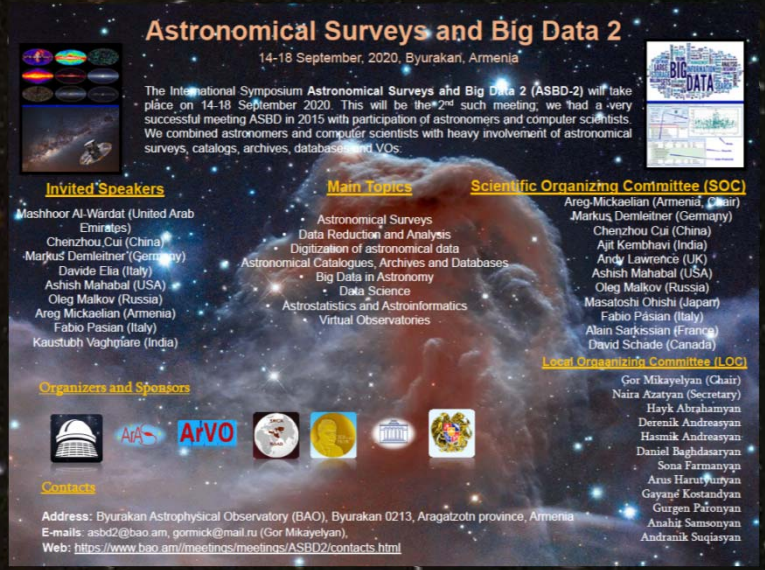




ArVO – Armenian Virtual Observatory

Meetings and Events:

- 7th Byurakan International Summer School (7BISS), *07-11.09.2020, Byurakan, Armenia*
- Astronomical Surveys and Big Data 2 (ASBD-2), *14-18.09.2020, Byurakan, Armenia*



Recent publications:

Demleitner, M.; Mickaelian, A.; Mikayelyan, G.; Knyazyan, A.; Baghdasaryan, D. *Outlier Analysis in Low-Resolution Spectra: DFBS and Beyond*, GAVO, 2019

Mickaelian, A. M.; Sarkissian, A.; Berthier, J.; Meftah, M.; Thuillot, W.; Vachier, F. *Search and study of asteroids from the digitized first Byurakan survey using virtual observatory tools*. Icarus 330, p. 5, 2019

Gevorgyan, Gh.; Knyazyan, A. V.; Astsatryan, H. V.; Mickaelian, A. M.; Mikayelyan, G. A. *Astronomical objects classification based on the Digitized First Byurakan Survey low-dispersion spectra*. A&C, 2020. in press

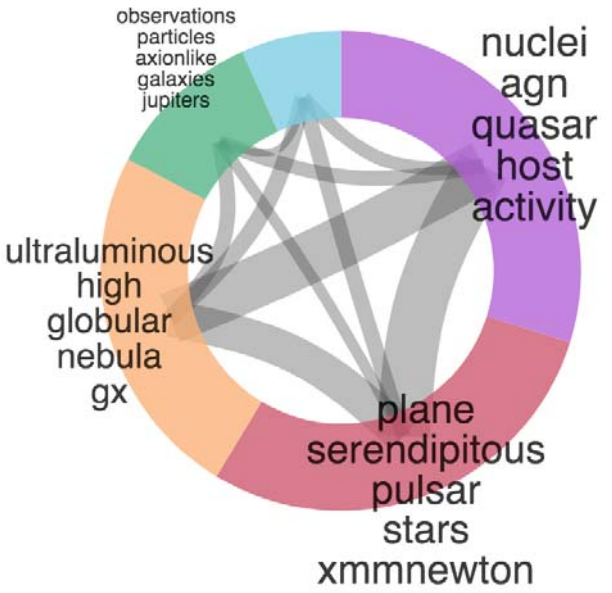
USVOA/NAVO

- Will be hosting the workshop "Using Python to Search NASA's Astrophysics Archives."
- Database benchmark service has been built on Amazon Web Services.
- Starting to look at implications of science platform workflows on underlying services, including VO standards
- Release of source code of nexsciTAP, python based TAP server, at https://github.com/Caltech-IPAC/nexsciTAP.

The Chandra Source Catalog 2.0 and relevant activities

- CSC 2.0 was **released** officially on *2019 Oct 24*
  → Includes ~376K unique X-ray sources, ~928K detections, ~36TB science-ready FITS data products
  → **Accessible** through CSCview, CSC WWT & VO interfaces
- *Spring 2020*: CSC 2.0 catalog available in **ESAsky**
- *Spring 2020*: Started minting **DataCite DOIs** as dataset persistent identifiers in *Chandra* data products
- *Fall 2020*: **Reprocessing** the entire *Chandra* mission dataset in part to prepare for the next CSC production run
- **Presented** CSC 2.0 at summer virtual AAS (webinar and CXC booth) and at the 5th Arab Astronomical Society School for Astrophysics

Excellent **broad** CSC impact in the last 2 years: ~100 refereed papers quoting the CSC, ~900 citations, ~28K reads



CENTER FOR ASTROPHYSICS
HARVARD & SMITHSONIAN

VObs.it

VObs.it is the Italian initiative to support the VO.

- Activity in IVOA within WGs and IGs
- Chairing DAL+GWS
- IVOA documents coordination
- Funding for development of standards and provision of services for IVOA is granted by INAF: fairly constant over time (lower this year due to lack of travel)
- Person-power: ~ 3 FTE/year (1.5 dev. + 1.5 service)

Additional efforts to develop data access/ retrieval and applications compliant to IVOA standards at the two main Italian centres:

- IA2, the INAF centre for Astronomical Archives
- SSDC, the ASI Space Science Data Center (evolution of ASDC)

Each data centre has its own budget

VObs.it

VObs.it supports (on INAF-provided servers and resources) IVOA:

- **web pages (www.ivoa.net)**
- **wiki (wiki.ivoa.net)**
- **mail and lists (mail.ivoa.net)**
- **documents repository (www.ivoa.net/documents)**
- **vocabulary maintenance (www.ivoa.net/rdf)**

It also manages the

- registration of IVOA domains (ivoa.net and ivoa.info)
- the related DNS service
- resolving the other IVOA community provided services:
  - rofr.ivoa.net (currently hosted at CADC)
  - mail.ivoa.net/search (provided by CNRS/CDS)

Current efforts/activities:

- updates to the document repository
- smooth out historical heritage services
- Planning for a docs DNS resolved subdomain
- Also to link a documents search engine (CDS)

Euro-VO Activities

- Activities being pursued within the EC funded **ESCAPE** Project
  - In the 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
- ESCAPE is bringing VO into the European Open Science Cloud (EOSC)

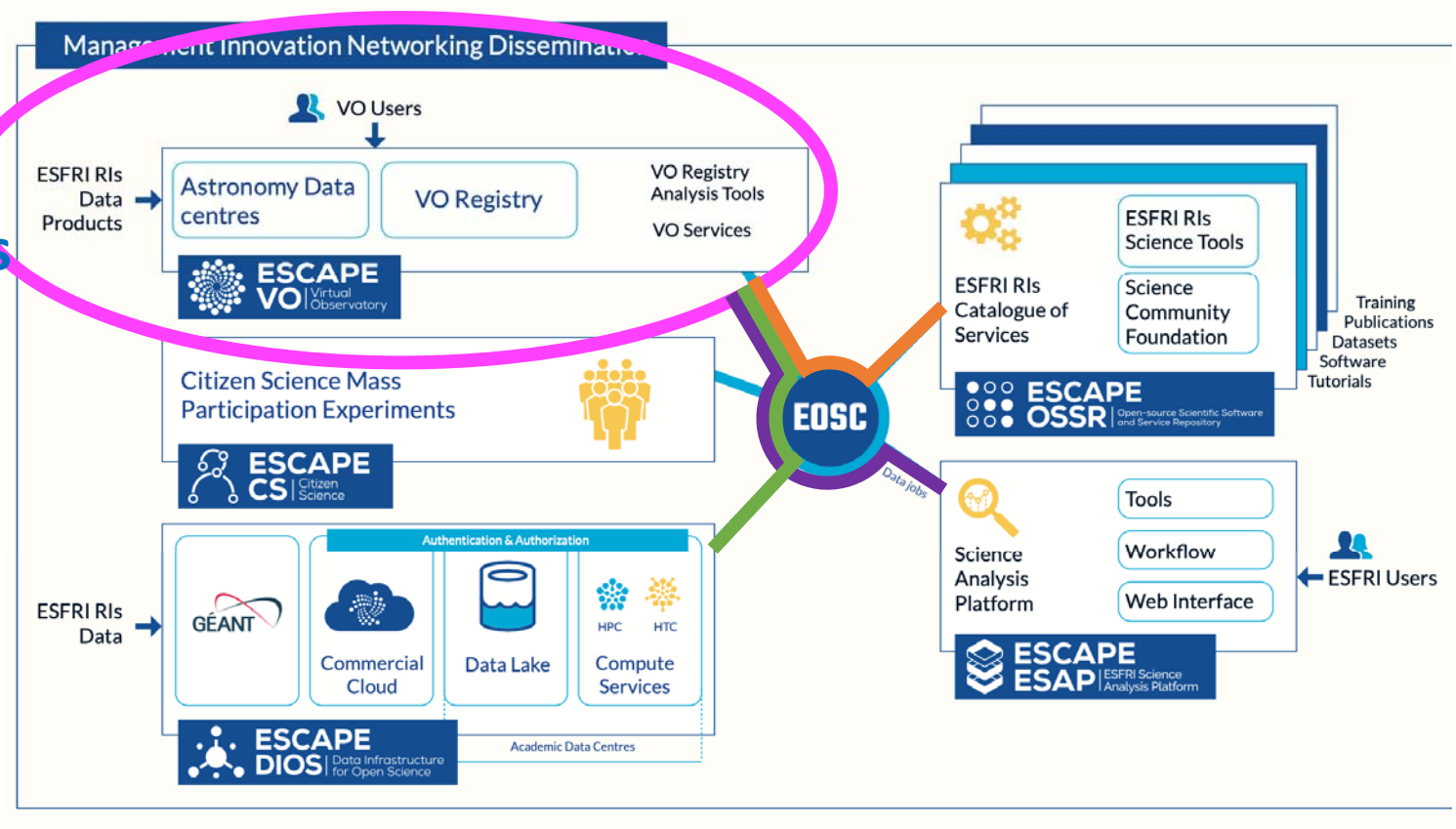
Funded by the European Union's Horizon 2020 - Grant N° 824064

VO in ESCAPE

VO is an integrated part of connecting ESFRI data and services to EOSC

In coordination with ESCAPE developments:

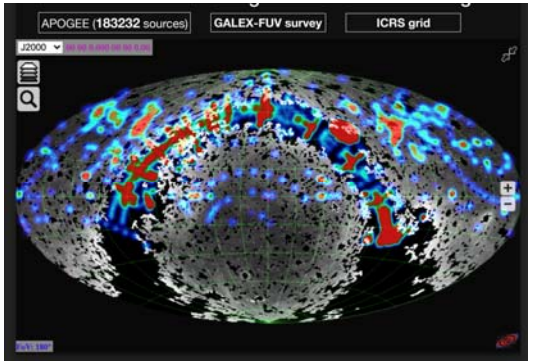
- **Software repository**
- **Data Lake**
- **Science platform**



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

Euro-VO Status and Highlights

- **ESCAPE project Feb 2019- Jan 2023 – mid-term review Nov 2020**
  - Defined VO needs of European Astronomy/Astroparticle/Solar/Grav Wave infrastructures
  - VO registry in EUDAT B2FIND re-implemented and improved
  - Input to **RDA** *FAIR Data Maturity Model WG*, **FAIRsFAIR** project, **EOSC** consultation
  - Tools/services: e.g: ASTRON services registered, WebGL Aladin Lite prototype, mocpy, +…
  - Work toward VO in Science Platforms (containerisation etc.)
  - Deliverables etc. - **(https://projectescape.eu)**



- **Recent Activities:**
  - **ESCAPE Provenance Workshop** (7-8 September 2020)
  - **ADASS 2020: Tutorial** on *Multi-messenger astro. with pyVO & ObsTAP* **Aladin Lite** *v3*, **Provenance** and **Radio Astronomy BoFs, STMOC for GWs,** *+ more*
- **Upcoming:** VO school *(on-line 8-12 Feb 2021),* Data Provider Forum *(~June 2021),* Tech. Forum *(~March/April 2021),* new Euro-VO web pages to be launched soon!

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

All-Sky Virtual Observatory News

Overall: All nodes have Single-Sign On (using Data Central), working on

Data Central and SkyMapper

- Data Central SIA service now in production; SSA under development for release shortly
- GALAH Data Release 3 and OzDES Data Release 2 now available on Data Central
- SkyMapper preparing for Data Release 4

Theoretical Astrophysical Observatory

- New visualization tool under development (Vis3D)
- Currently reviewing the UI/UX, to reassess how new components fit into the rest of TAO

MWA

- Investigating Rucio (CERN data management and replication system) which is complex and not for the faint-hearted!
- New UI/UX improvements

CASDA

- ASKAP data coming in for different surveys (RACS, EMU, WALLABY, GASKAP)
- Two online tutorial sessions held demonstrating the VO services in CASDA

And now – to work !!

IVOA November 2020 Interoperability Meeting

17-19 November 2020
Online
UTC timezone

Overview
Programme
Registration
Call for Contributions
Participant List

Meeting help-desk
virtual2020@ivoa.net

The IVOA Novermber 2020 Interoperability meeting organization will be similar to the last (May) Interoperability Meeting. We will use Zoom as our shared remote service, and Etherpad for live notes and questions. We are planning to keep presentations to a single thread (no parallel sessions) and save a good amount of the time for your input and discussion. Sessions will be recorded and posted so that if you miss a session you can go back and view it. We will work to schedule sessions with reasonable times during the day for 2 of the 3 sessions a day in your time zone

The meeting schedule will be made up of sessions of the IVOA Working Groups and Interest Groups. In addition, we envision asking the community for topics/presentations as we did last time. We plan to make a slight adjustment in that we will welcome smaller proposals with >1 presenter in a session as well as longer proposals that take the hour.

The meeting schedule (very preliminary draft) is available here.

Starts 17 Nov 2020, 04:30
Ends 19 Nov 2020, 23:00
UTC

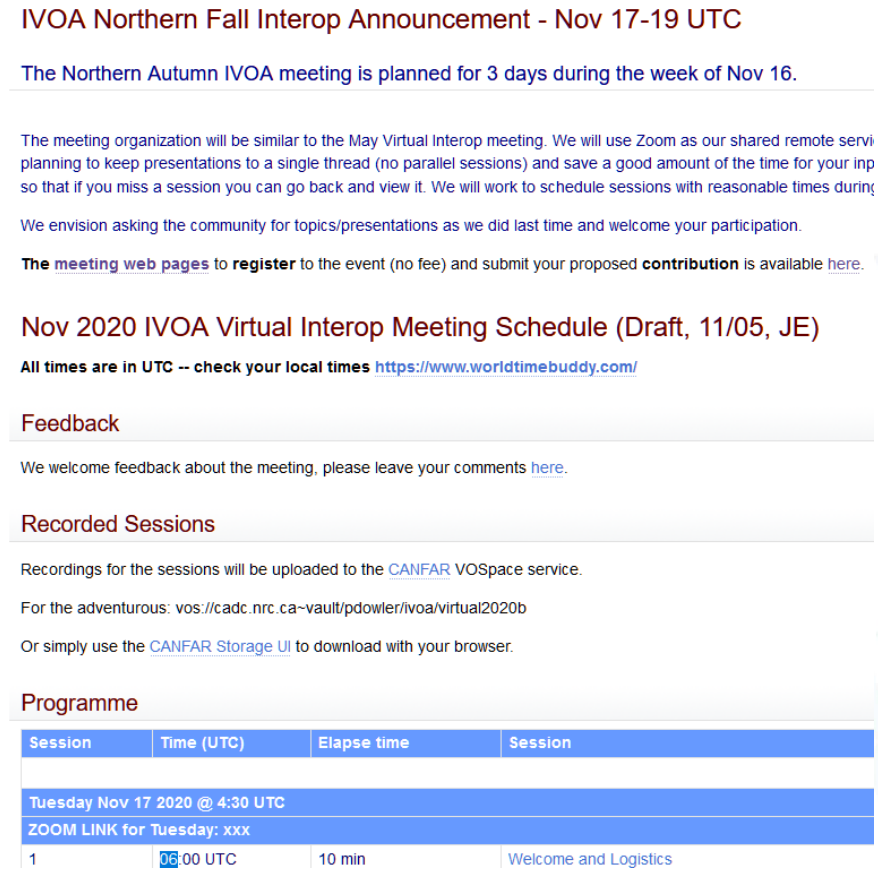
Online

POC/TCG coordination:

- Patrick Dowler [CADC] (email)
- Janet Evans [CfA | Harvard & Smithsonian] (email)

VLoc:

- Marco Molinaro [INAF & VObs.it](email)



IVOA Northern Fall Interop Announcement - Nov 17-19 UTC

The Northern Autumn IVOA meeting is planned for 3 days during the week of Nov 16.

The meeting organization will be similar to the May Virtual Interop meeting. We will use Zoom as our shared remote servi
planning to keep presentations to a single thread (no parallel sessions) and save a good amount of the time for your inp
so that if you miss a session you can go back and view it. We will work to schedule sessions with reasonable times durin

We envision asking the community for topics/presentations as we did last time and welcome your participation.

The meeting web pages to **register** to the event (no fee) and submit your proposed **contribution** is available here.

Nov 2020 IVOA Virtual Interop Meeting Schedule (Draft, 11/05, JE)

All times are in UTC -- check your local times https://www.worldtimebuddy.com/

Feedback

We welcome feedback about the meeting, please leave your comments here.

Recorded Sessions

Recordings for the sessions will be uploaded to the CANFAR VOSpace service.

For the adventurous: vos://cadc.nrc.ca~vault/pdowler/ivoa/virtual2020b

Or simply use the CANFAR Storage UI to download with your browser.

Programme

Session	Time (UTC)	Elapse time	Session
Tuesday Nov 17 2020 @ 4:30 UTC			
ZOOM LINK for Tuesday: xxx			
1	06:00 UTC	10 min	Welcome and Logistics