



# ESCAPE

European Science Cluster of Astronomy &  
Particle physics ESFRI research Infrastructures

## WP4 Technology Forum 2



# Welcome to Technology Forum 2.

- A meeting of the whole Work Package – month 27 of 48.
- Interaction with invited experts (EUDAT, Radio, Applications, VO)
- Interaction with WP3 (Software), WP5 (Platform)
- Reports on progress
  - From the Review held in November 2020
  - From the individual tasks 4.1, 4.2, 4.3
  - From the partners and also invited contributions
  - Hack-a-thon sessions – *working meeting!!*
- Prepare for the 2<sup>nd</sup> half of the ESCAPE
- Prepare for the upcoming IVOA Interoperability meeting (May 2021)



# Logistics

- Meeting held in Zoom
  - Zoom links for each day will be provided by the participant email list
  - Please mute while not speaking
  - Please use the raise-hand feature and the chat
- Interactive virtual meeting place – Gather Town
  - For coffees, lunches, extra discussion
  - Somewhat of a test after the successful WP3 use in the IWAPP workshop
  - Link to be sent before the 1st coffee
- Code of conduct
  - As usual for ESCAPE meetings – please be respectful in all ways
- Recording
  - We did not request permission or recordings
  - Prefer to favor discussion without recording
  - Some requests for recording of a presentation may be made



# 1. Introduction – WP4 “**CEVO**”

Connecting **E**SFRI projects to EOSC through the **VO** framework

- **EOSC** – European **O**pen **S**cience **C**loud
- **VO** – **V**irtual **O**bservatory

*Virtual Observatory standards and methods for FAIR principles to a larger scientific context; demonstrating EOSC capacity to include existing frameworks.*



## Partners from ESFRIs and astronomy Research Infrastructures

ESO



SKAO

NWO-I-ASTRON



JIVE



CTAO



KIS

ORB



EGO



CNRS-OBAS  
CNRS-CPPM



INAF



THE UNIVERSITY  
of EDINBURGH

UEDIN



UHEI



INTA

Heidelberg Institute for  
Theoretical Studies



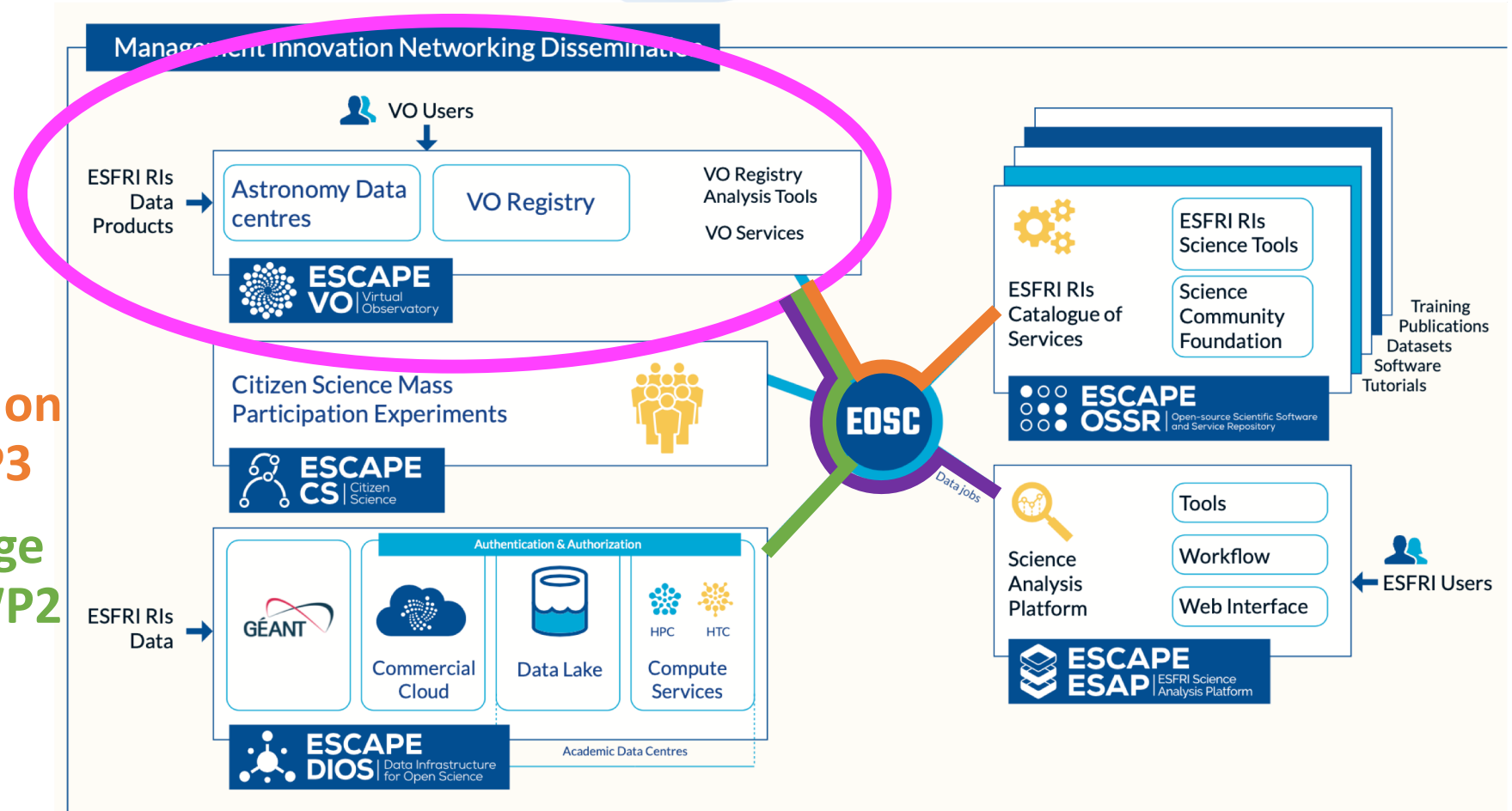
HITS  
(WP3)

## Partners bringing experience from European Virtual Observatory



# 1.1 Virtual Observatory – part of the ESCAPE cell

- Connect ESFRI and RI data to EOSC by VO
- Metadata standards based on ESFRI needs
- **Software connections on deep learning with WP3**
- **VO connected to storage and computing with WP2**
- **VO data via platform with WP5**



## 1.2 The aspects addressed by WP4 are to:

- Assess and implement the connection of **ESFRI** and other **astronomy research infrastructures** to the **EOSC** by the **Virtual Observatory**
- Refine and pursue implementation of **FAIR principles for astronomy** data via common interoperability standards - extending the VO to new communities
- Establish **data stewardship practices** for adding value to scientific content of ESFRI data archives



# Making data FAIR with the Virtual Observatory.

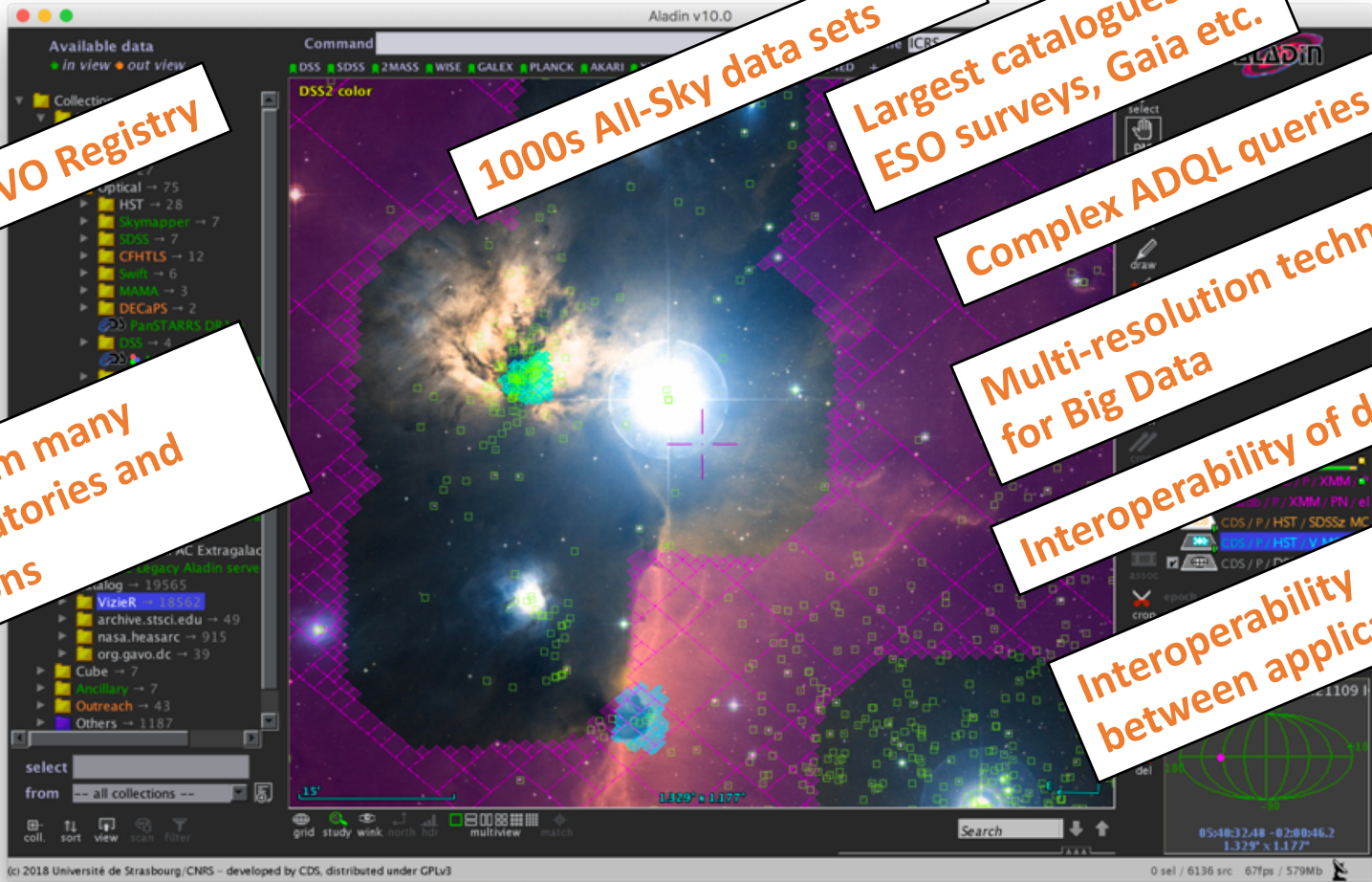
The Virtual Observatory is:

- **An operational framework** for interoperable access to astronomical data and services
- **A pioneer of FAIR data sharing** - an existing global framework – populated by major data providers (space and ground based) that is heavily used by the community (*e.g. ESA Gaia mission data access is fully VO*)
- **Built on International Virtual Observatory Alliance (IVOA) standards**
  - *Recognised in the ESFRI roadmap (2018)*
  - *Quoted as an example in EOSC SRIA document (v0.8, Oct 2020)*
- **Supported in Europe** by **Euro-VO** (*VO Partners + EC projects since ~2001*)
  - *Recognised in ASTRONET roadmap (2008, 2014)*





# One view of the VO from an application/portal :



**Built from VO Registry**

**1000s All-Sky data sets**

**Largest catalogues: ESO surveys, Gaia etc.**

**Complex ADQL queries**

**Multi-resolution techniques for Big Data**

**Interoperability of data**

**Interoperability between applications**

Available data  
in view out view

Command

DSS SDSS ZMASS WISE GALEX PLANCK AKARI

DSS2 color

Optical → 75  
HST → 28  
SkyMapper → 7  
SDSS → 7  
CFHTLS → 12  
Swift → 6  
MASS → 3  
DECaPS → 2  
Pan-STARRS → 1  
DSS → 4

select  
from -- all collections --

coll. sort view scan filter

grid study wink north bar multiview match

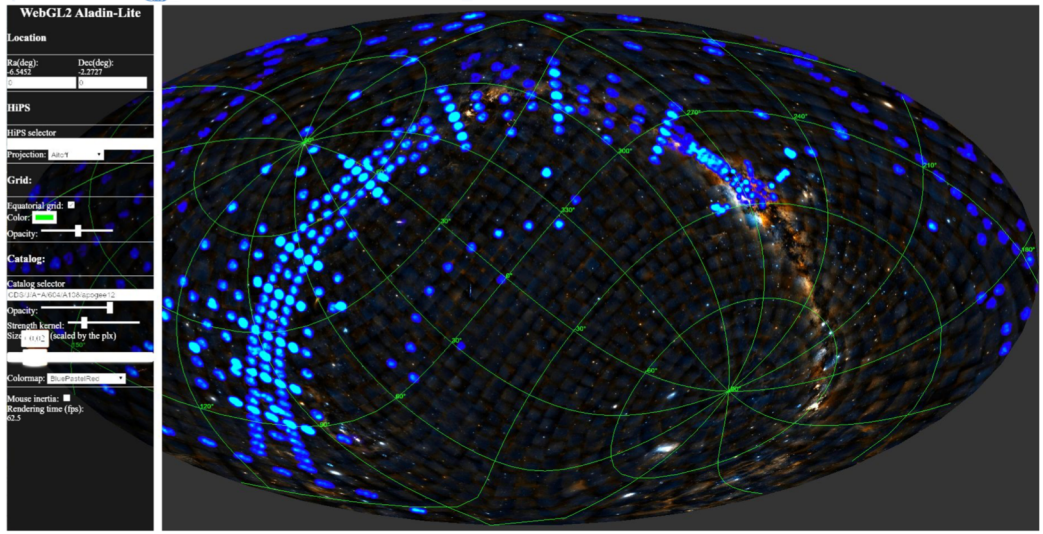
Search

0 sel / 6136 src 67fps / 570Mb

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



# CEVO: VO interoperability in context of ESCAPE / EOSC



New improved WebGL Aladin Lite

```

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 nloadTable&outputFormat=vot&filename=vizier_M101_II_328_allwise_20190322', {'color': 'red', 'onClick': 'showTable'})
        2
        3
    
```

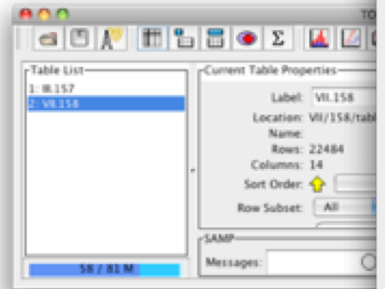
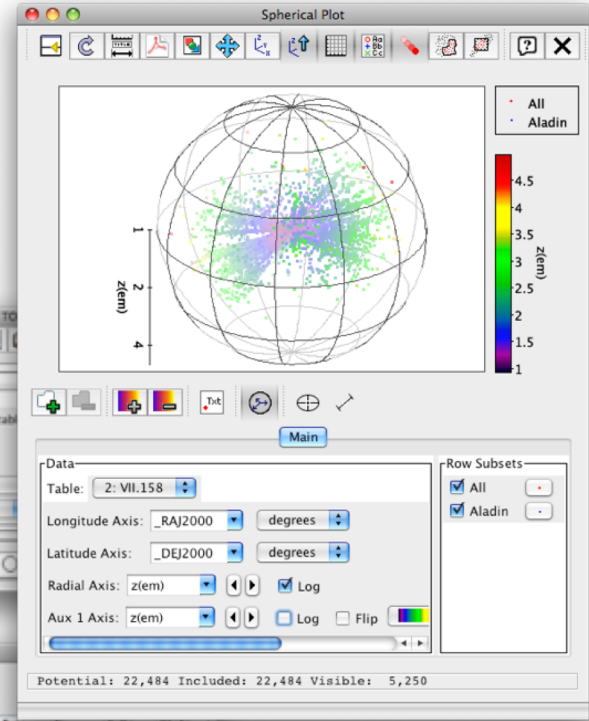
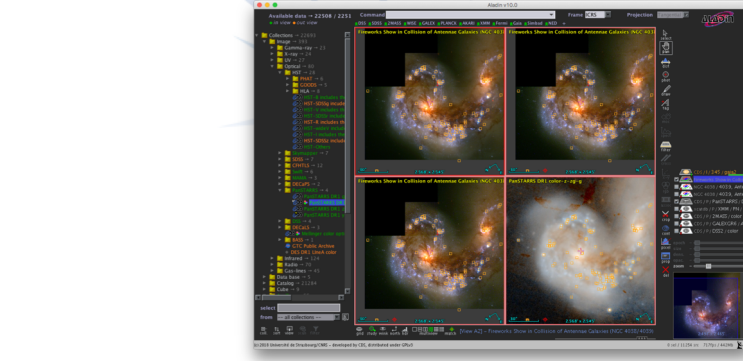


Table Browser for 1: III.157

Seq	QSO	Name	z	Vmag	Type	No.	Class	ObsSp
31	1133+704	Mk 180	0.046	14.49	BLZ	1	CaSp	ObsSp
32	1146-037	PKS	0.341	16.9	QSO	1	CaSp	ObsSp
33	1148+549	PG	0.969	15.82	QSO	1	CaSp	ObsSp
34	1156+295	4C 29.45	0.729	14.41	BLZ	1	CaSp	ObsSp
35	1202+281	PG	0.145	15.51	QSO	1	CaSp	ObsSp
36	1211+148	PG	0.085	14.63	QSO	1	CaSp	ObsSp
37	1219+755	Mk 205	0.07	14.5	SY1	2	CaSp	ObsSp
38	1225+317	B2	2.219	15.87	QSO	1	CaSp	ObsSp
39	1226+078	JC 273	0.158	12.84	QSO	2	CaSp	ObsSp
40	1229+204	TON 1542	0.064	15.3	SY1	2	CaSp	ObsSp
41	1241+176	PG	1.273	15.38	QSO	1	CaSp	ObsSp
42	1253-055	JC 279	0.538	17.75	BLZ	2	CaSp	ObsSp
43	1302-102	PKS	0.285	14.92	QSO	2	CaSp	ObsSp

Notebooks & Platforms

TOPCAT

Broadcast



## 1.3 Virtual Observatory – a part of EOSC

- **Integration of an existing interoperability framework**
  - Domain specific thematic services supporting Open Science
  - VO makes data FAIR by use of standards
- **Brings common metadata standards**
  - IVOA standards responding to the needs of ESFRI, RIs and researchers
  - Building on significant national / European / International investment
- **EOSC to enable next steps of VO**
  - Connection to computing and integration into ESCAPE platform
  - Scalability for big data
- **Data stewardship practices of Astrophysics in EOSC context**
- **Developing the vision of next generation astro ESFRI archives**



## 2. Progress in Reporting Period 1

### Overview:

Interaction with all partners → **WP4 Detailed Project Plan (D4.1)**

**Task 4.1** Integration of astronomy VO data and services into the EOSC

- Interaction with EOSC projects (+RDA), VO registry in B2FIND, tests of service publishing

**Task 4.2** Implementation of FAIR principles for ESFRI data through the Virtual Observatory

- 3 Milestones – representation of ESCAPE priorities at IVOA level

- ESFRI/RI partners requirements defined:

→ Intermediate Analysis Report on use of IVOA Standards for FAIR ESFRI and Community Data (D4.2)

- *Implementations of standards and progress on development of standards*

- **Task 4.3** Adding value to trusted content in astronomy archives

- **First results of deep learning applied to archive data sets (joint with WP3)**



## 2.1a Highlight: WP4 Technology Forum 1. (Feb 2020)

- Major Work Package meeting (+ WP3, WP5 interaction)
- Invited experts and collaborators
  - **EUROPLANET, TOPCAT-developer, ObsParis – Radio & Solar expertise, ESA** (Videocon)
- Progress presentations + *Hack-a-thon* working meeting sessions
- Report of test of the RDA FAIR Data Maturity Model WG
  
- **Mapping VO expertise – ESFRI needs**
- **Live demos and coding**
- **First results...**



# 2.1b Highlight : VO in B2FIND - Demonstrates 1<sup>st</sup> level of metadata compatibility

- Links to the actual service
- enables feedback to EOSC



IVOA

**22,234 datasets found for "IVOA"**

**ESO TAP\_OBS: a TAP service to browse and access raw and red**  
 TAP\_OBS is the ESO Science Archive TAP endpoint for observations (raw and red) and ambient measurements (atmospheric seeing, turbulence, water vapour, r...

**UCL DaCHS server TAP service**  
 The UCL DaCHS server's TAP end point. The Table Access Protocol (TAP) lets you execute queries against our database tables, inspect various metadata, and upload your own data.

Dataset Communities

## The VO @ ASTRON TAP service

The The VO @ ASTRON's TAP end point. The Table Access Protocol (TAP) lets you execute queries against our database tables, inspect various metadata, and upload your own data. It is thus the VO's premier way to access public data holdings.

Tables exposed through this endpoint include: main from the lbcsc schema, main, mom0 from the sauron schema, img\_main, main from the mvf schema, columns, groups, key\_columns, keys, schema, main, msssvf\_img\_main from the tap\_schema schema, hetdex\_images, img\_main from the hetdex schemas, tables from the tap\_schema schema, obscure from the ivoa schema, img\_main from the msss schema, obscure from the ivoa schema.

ADQL Catalogs Virtual observatory

Identifier	<a href="https://vo.astron.nl/_system_/tap/run/info">https://vo.astron.nl/_system_/tap/run/info</a>
Source	<a href="http://dc.g-vo.org/rr/q/pmb/verb=GetP...">http://dc.g-vo.org/rr/q/pmb/verb=GetP...</a>
Metadata Access	
Provenance	



# 2.1c Highlight – Interaction with EOSC projects

## Interactions

- **FAIRsFAIR** project
  - Synchronisation Force – workshops, representation of ESCAPE, and report
  - FAIR Champions group – workshops and communication to community
  - Metadata Catalogue integration (interdisciplinary) – workshops and report input
- **EOSC Enhance**
- **EOSC-Hub**
- **FREYA** project

## Interaction with Research Data Alliance

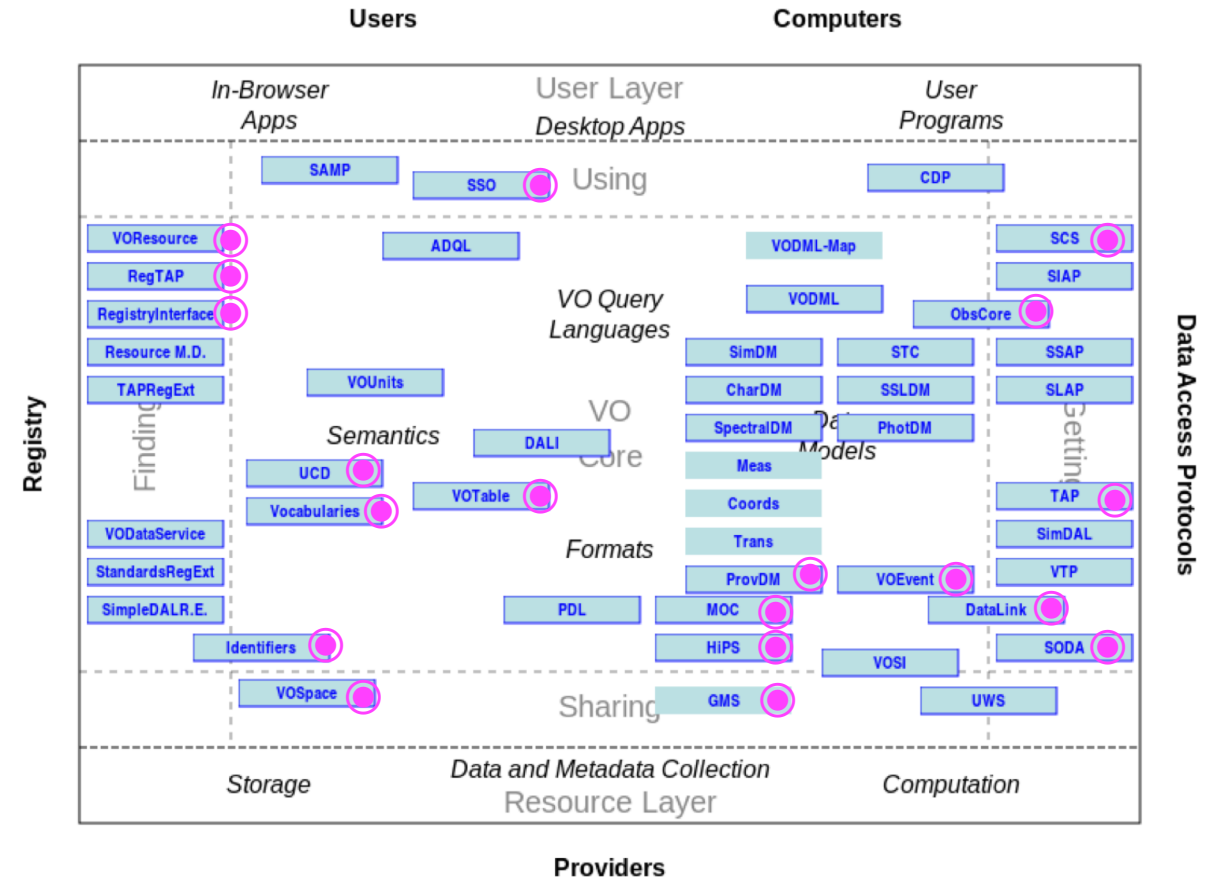
- Evaluation of core criteria for FAIR data
  - Input to the RDA FAIR Data Maturity Model Working Group

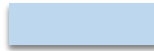



## 2.1d Highlight: Implementations of IVOA standards



- **Gravitational Waves (EGO-Virgo)** – Space time indexing and use in applications for GW follow-up
- **Solar physics (EST)** – Analysis of IVOA semantic UCD metadata for solar physics.
- **Radio Astronomy** – interoperability and data volume aspects, new Radio Astronomy services registered in VO registry, standardized metadata for radio astronomy (JIVE, ASTRON, SKAO, ALMA)
- Relevant standards discussed in ESCAPE @ IVOA 🌟



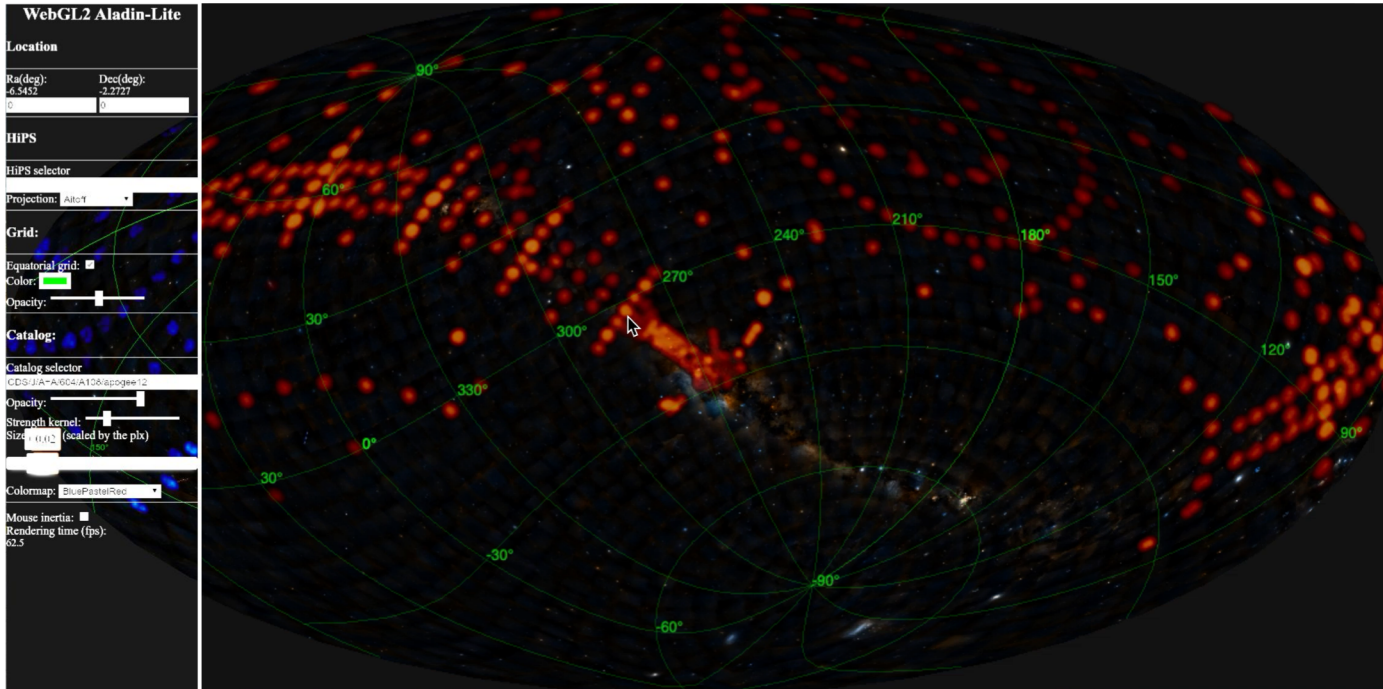
-  Working Draft
-  IVOA Recommendation

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





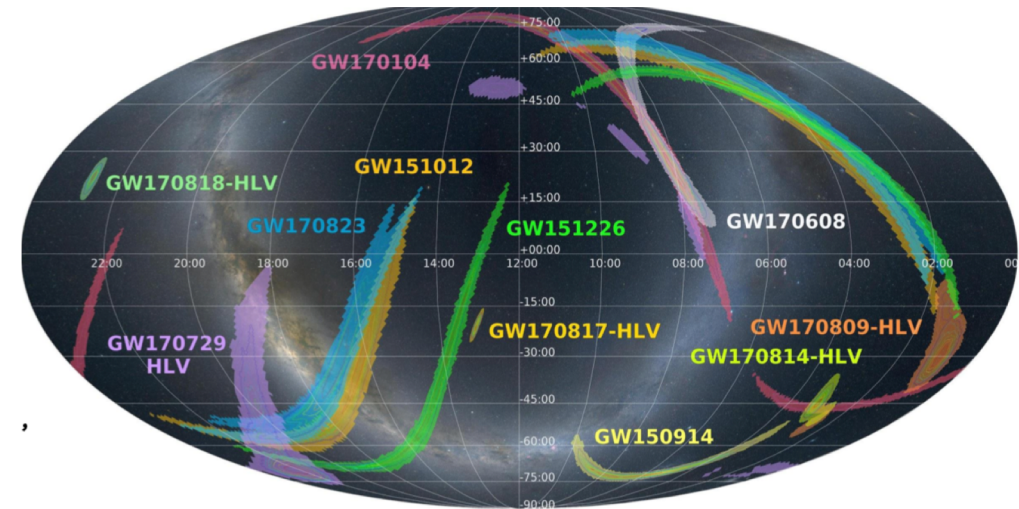
# e.g. progress on data access and visualisation



Prototype WebGL-enabled visualization component (Aladin Lite) for portals / platforms

IVOA MOC standard adapted for GW sky localization:

- Included into LIGO user guide
- (will be a legacy of ESCAPE)



## 2.2 Interfaces and cooperation with WPs

### WP3:

Interaction with EOSC bodies on metadata and interfaces

Joint work on ***Deep Learning applied to the ESO archive***

- Scope: provide archive users with novel ways to identify data
- Going beyond query parameters approach – ***Let the data speak!***
- Applied to HARPS archive (~270k spectra) to enable ***Search for ‘similar spectra’***

### WP5:

Cooperation for ***VO data to be discoverable/usable in ESAP***

- Cross-WP activities on use of IVOA protocols

### WP2:

Interface on connection of VO to computing

- identified benefits of VOSpace package on top of RUCIO



## 2.3 Status of Milestones and Deliverables

### 2.3a Milestones: “Progress and priorities at IVOA”

1st Milestone – **Paris IVOA meeting** (*May 2019, MS20*). ✓

- Introduction of solar physics requirements at IVOA, EST partners
- EUDAT participation – registry integration
- **30** contributions from ESCAPE partners, ESCAPE highlighted at IVOA level

2nd Milestone – **Groningen IVOA meeting** (*November 2019, MS21*). ✓

- Focus on Radio/mm astronomy – SKAO, LOFAR, JIVE, ALMA + international radio projects -- leading to IVOA Interest Group on Radio Astronomy
- Space-time metadata for indexing of astronomy data
- **22** contributions from ESCAPE partners

3rd Milestone – **On-line IVOA meeting** (*May 2020, MS22*). ✓

- Radio Astronomy IVOA IG formed – ESCAPE member is Vice Chair
- Data Curation and Preservation – assessment of RDA FAIR Data Maturity Model
- **22** contributions from ESCAPE partners



## 2.3 Status of Milestones and Deliverables

4th Milestone – **On-line IVOA meeting** (*November 2020, MS23*). ✓

- Presentation of ESCAPE Provenance results at IVOA
- ASTRON, JIVE presentations in Radio IG sessions
- Many ESCAPE presentations at the preceding ADASS (→ ESCAPE conference papers)
- **14** contributions from ESCAPE partners

### Up-coming:

5th Milestone – **On-line 5-day IVOA meeting** (*May 2021, MS25*).

6th Milestone – **On-line 2.5-day IVOA meeting** (*November 2021, MS26*).



## 2.3b Deliverables

### **D4.1 - WP4 Detailed Project Plan** *(July 2019)* ✓

*Built by interaction from all partners. Being used to track progress.*

### **D4.2 - Intermediate Analysis Report on use of IVOA Standards for FAIR ESFRI and Community Data** *(March 2020)* ✓

*Assessment of the initial ESFRI requirements for VO standards and tools.*

*Gathers and analyses the results from the Milestones.*

*Sets priorities for the next steps.*

### **D4.3 – 1st Science with Interoperable Data School** *(originally planned May 2020)*

*On-line event 8-12 (+19) February 2021* *(Report in progress for April 2021)*

### **D4.4 - Intermediate analysis report of VO data and service integration into EOSC**

*Work completed in RP1* *(Deliverable moved July 2020 -> Nov 2020)* ✓



## 2.4 Risk mitigations

EOSC does not meet the needs of the ESFRI. (Low)	WP4	Use ESCAPE participation in EOSC to bring requirements and feedback so that developers and users of EOSC can work towards convergence.	Active participation in EOSC events, input to SRIA and cluster statements have expressed ESFRI needs
Difficulty to align the international IVOA priorities with those arising from ESCAPE. (Medium)	WP4	ESCAPE partners have leading roles in the IVOA and task 4.2 ensures representation of European priorities in IVOA.	Continue strong representation of ESCAPE in IVOA as done in RP1
EOSC operational framework is delayed (Medium).	WP4	Use an incremental adoption plan for use of the EOSC.	All steps so far are incremental

### Other risks identified at RP1:

**Risk** – Premature departure of contract personnel.

**Mitigation** – Partners manage contractors, and ensure intermediate results are documented.

**Risk** – On-going pandemic prevents in-person training events.

**Mitigation** – Significant efforts are being made to adapt training activities to on-line events.



## 3. Deviations

Delayed Deliverables and Milestone due to covid-19

**D4.3 – 1st Science with Interoperable Data School** (*delayed to May 2020*)

Now organized as an on-line event 8-12 February 2021

**D4.4 -- Intermediate analysis report of VO data and service integration into EOSC**

Work completed in RP1, but report delayed (*July 2020 -> Nov 2020*)

**D4.5 – Prototype Demonstrator for value added archive services**

Delayed (*July 2021 -> Jan 2022*)

**MS28 -- Hands-on Workshop for Data Providers**

Delayed (*Dec 2020 -> June 2021*)

*With continuing situation, may need to consider pushing other deliverables to later dates, but completely feasible within extended project timeline*



## 4. WP4 Lessons Learned

- **Diversity of needs/requirements from the different ESFRI/RI & different levels of development of each ESFRI/RI.**
  - Required an approach of specific meetings – adapting to needs and goals.
  - Capacity building in VO expertise at ESFRIs required dedicated effort. Done via:
    - WP4 Tech Forum, ESFRI participation in IVOA interop working meetings, and dedicated visits.
- **It is a challenge to explain EOSC to the research community – while the vision of EOSC is being formed and evolving rapidly. (*But we're doing it!*)**
- **Learned to adapt to timelines controlled by individual partners**
  - in particular when number of PM < 15, or spreading resources over multiple work packages.





## 5. Next Steps for WP4

### Check on status compared to Work Plan (*D4.1*)

- To be adjusted based on progress and evolutions

### Important focus on training events in 2021

- ...following covid-19 delays that delayed events
- 1<sup>st</sup> School on Science with interoperable Data – done
- Hands-on workshop for data providers
  - On-line June 2021
- 2<sup>nd</sup> School on Science with Interoperable Data
  - December 2021 (or request to make later with revised project schedule)



## 5. Next Steps for WP4

### Cross- Work package activites

- WP3 – VO Software in the Software Catalogue (?)
- WP5 – help to enable VO services to be used in the ESAP Platform
- WP2 – Use of the Data Lake – e.g. HiPS in the Data Lake
- WP6 – Use of VO data in citizen science cases
- Involvement with Test Science Cases
  - To be discussed at project level
- WP4 work already has many science cases built-in
  - Need to express these more clearly, and make a list:
  - E.g. Implement scientific interoperability of Radio Astronomy data for the purpose of...
  - E.g. Use Deep Learning to identify similar data products in an operation archive to enable...
  - E.g. Apply VO metadata for solar physics to enable ...



# Reminder about WP4 information

- Wiki pages have the top-level information:
  - [https://wiki.escape2020.de/index.php/WP4\\_-\\_CEVO#Meetings\\_and\\_conferences](https://wiki.escape2020.de/index.php/WP4_-_CEVO#Meetings_and_conferences)



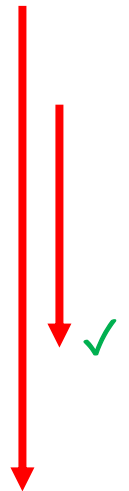
# Calendar : Deliverables and Milestones

● WP specific meetings

● Technology Forum – Strasbourg, 4-6 Feb, 2020

CEVO Project schedule table

Month 1	February 2019	
Month 2	March	
Month 3	April	
Month 4	May	
Month 5	June	<b>M4.1</b> Progress and priorities at IVOA ✓
Month 6	July	<b>D4.1</b> Detailed project plan for WP4 ( <i>This document</i> ) ✓
Month 7	August	
Month 8	September	
Month 9	October	
Month 10	November	<b>M4.2</b> Progress and priorities at IVOA ✓
Month 11	December	
Month 12	January 2020	
Month 13	February	
Month 14	March	<b>D4.2</b> Intermediate report on use of IVOA standards ✓
Month 15	April	
Month 16	May	<b>D4.3</b> 1st Science with interoperable data school
Month 17	June	<b>M4.3</b> Progress and priorities at IVOA ✓
Month 18	July	<b>D4.4</b> Intermediate analysis report of VO data and service integration into EOSC
Month 19	August	
Month 20	September	
Month 21	October	
Month 22	November	<b>M4.4</b> Progress and priorities at IVOA ✓
Month 23	December	
Month 24	January 2021	



We are here →

Month 25	February	On-line School
Month 26	March	
Month 27	April	Technology Forum 2
Month 28	May	M4.5 Hands-on workshop for data providers
Month 29	June	M4.6 Progress and priorities at IVOA
Month 30	July	D4.5 Prototype demonstrator for value-added archive services
Month 31	August	
Month 32	September	
Month 33	October	
Month 34	November	M4.7 Progress and priorities at IVOA
Month 35	December	D4.6 2nd Science with interoperable data school
Month 36	January 2022	
Month 37	February	
Month 38	March	D4.7 Final analysis report on integration of VO data and services into EOSC
Month 39	April	
Month 40	May	D4.8 Final analysis report on IVOA standards and stewardship best practices
Month 41	June	
Month 42	July	



6 Month no-cost extension to January 2023



TBD

TBD

TBD

October 2022

