ESCAPE

European Science Cluster of Astronomy & Particle physics ESFRI research Infrastructures

FAIR data in Astronomy

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Changing landscape of Data Sharing

Convergence of principles and language:

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

- **Open Science**
  - Data sharing with open and seamless services to analyse and reuse research data to improve science

- **Stewardship**
  - Human skills for curation, quality content, data management, services

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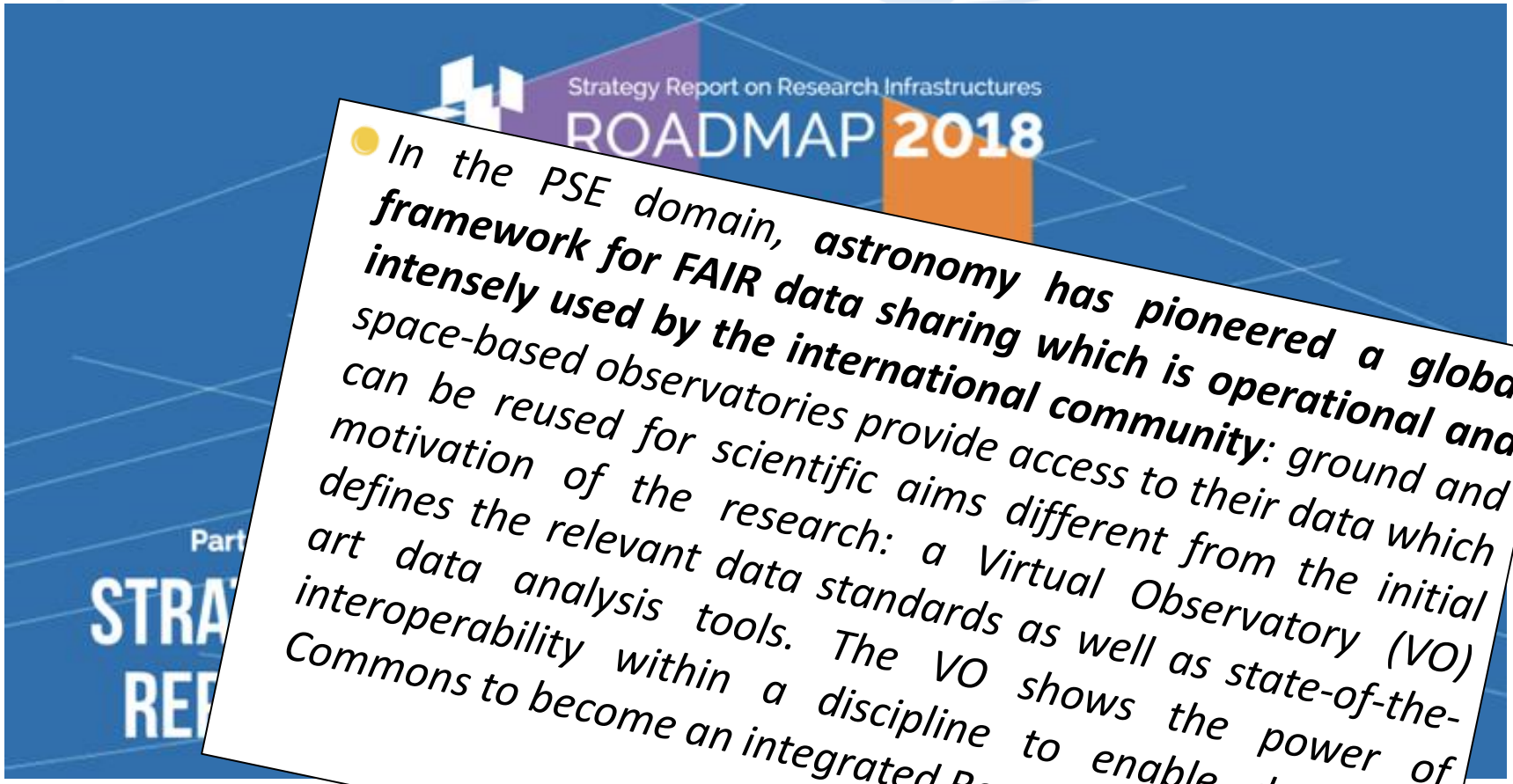
At the ESFRI level: pioneering effort recognised



- *In the PSE domain, **astronomy has pioneered a global framework for FAIR data sharing which is operational and intensely used by the international community**: ground and space-based observatories provide access to their data which can be reused for scientific aims different from the initial motivation of the research: a Virtual Observatory (VO) defines the relevant data standards as well as state-of-the-art data analysis tools. The VO shows the power of interoperability within a discipline to enable data and Commons to become an integrated Research Infrastructure.*

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N° 824064

In Europe… there is a new big initiative for data: **European Open Science Cloud (EOSC)**

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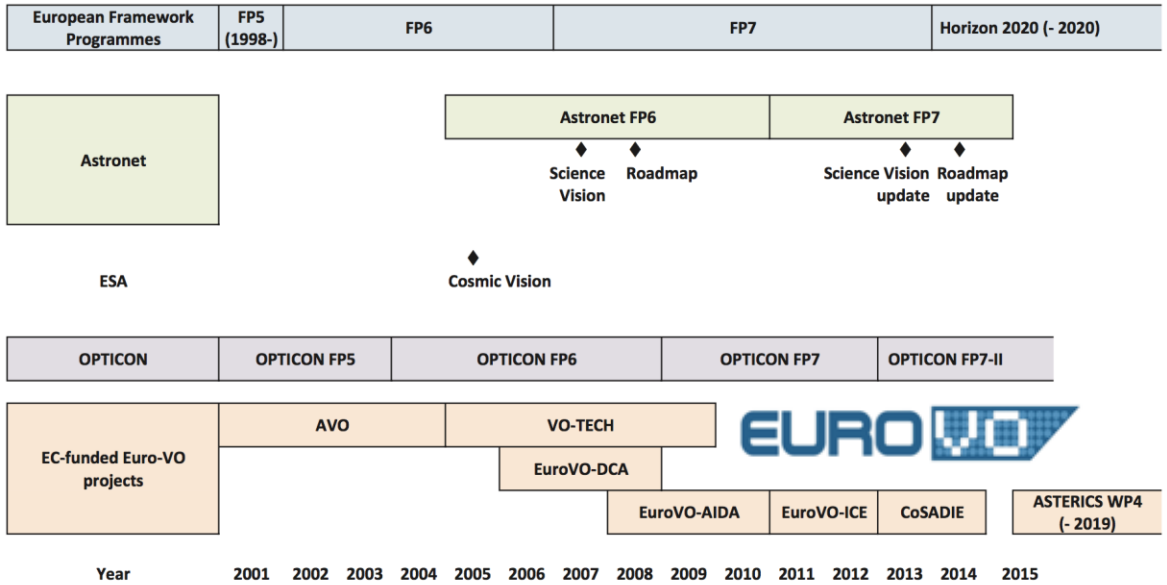
Background of the VO data aspects in Europe…
How we got here, and where we're going

- Virtual Observatory infrastructure for astronomy



Genova et al. 2015

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What is the Virtual Observatory?

- **Operational framework** for interoperable access to astronomical data and services across all areas of astronomy

- Provides unique scientific capabilities, opening up new ways of using rich data in astronomy archives 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. Gaia data access is fully VO)*

- **Re-used and customized** by planetary science (EuroPLANET), atomic and molecular physics (VAMDC) and materials sciences (via RDA Working Group)

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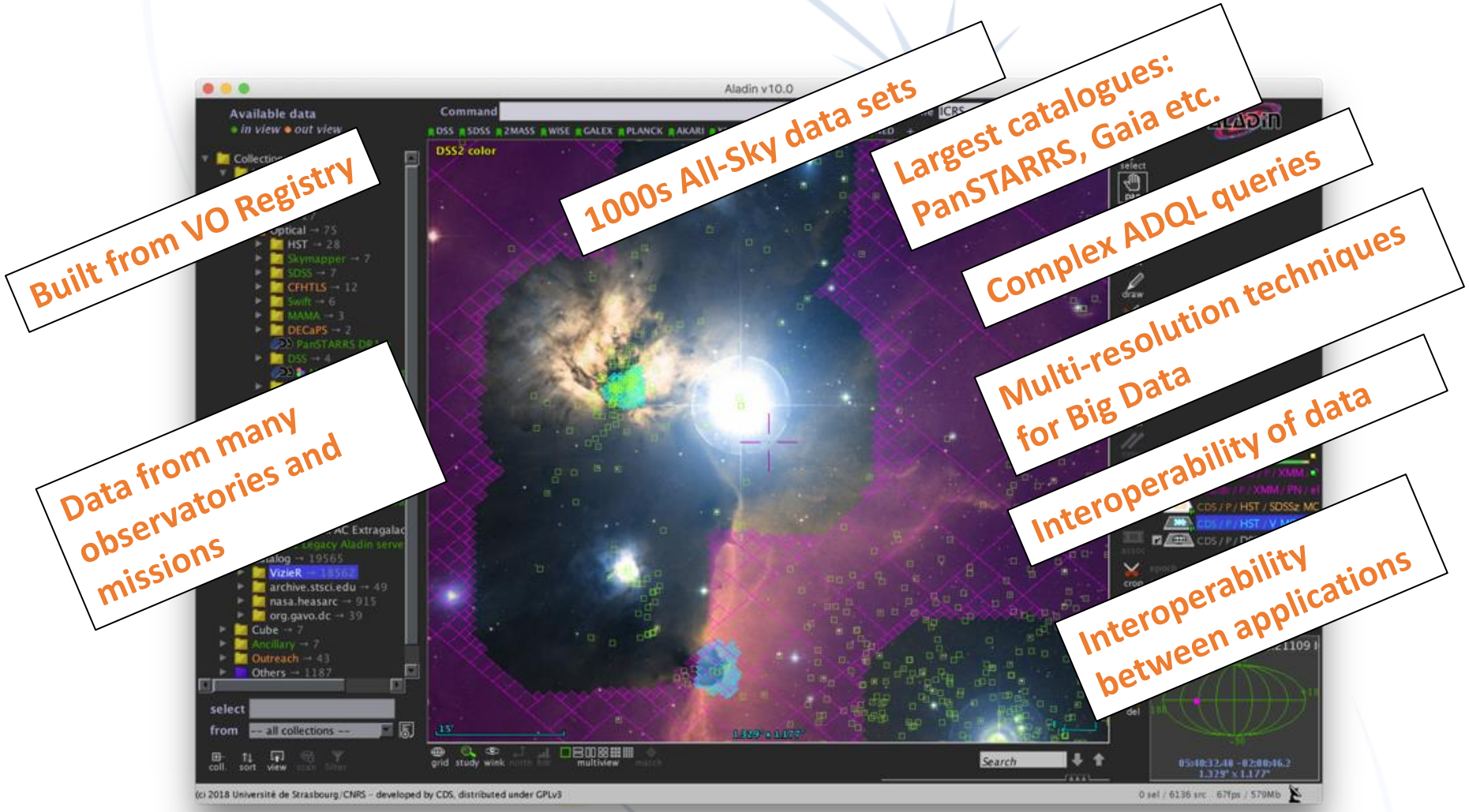
One view of the VO from an application:



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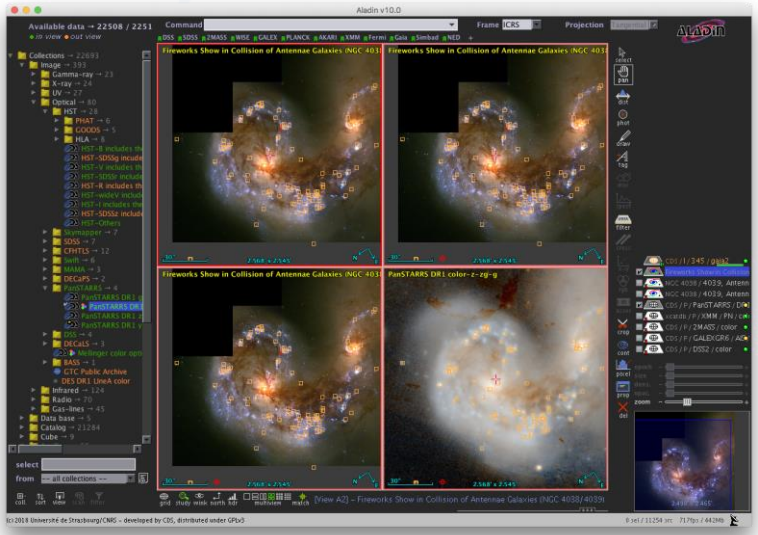
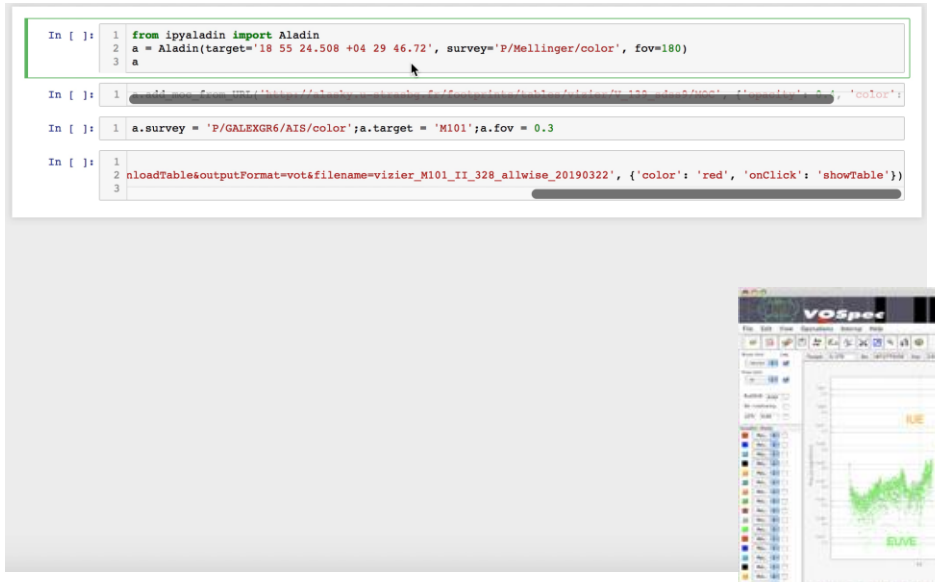
Interoperable applications and services

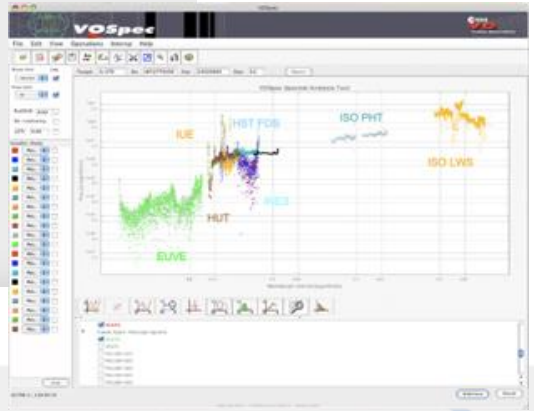


Data exploration and integration tools

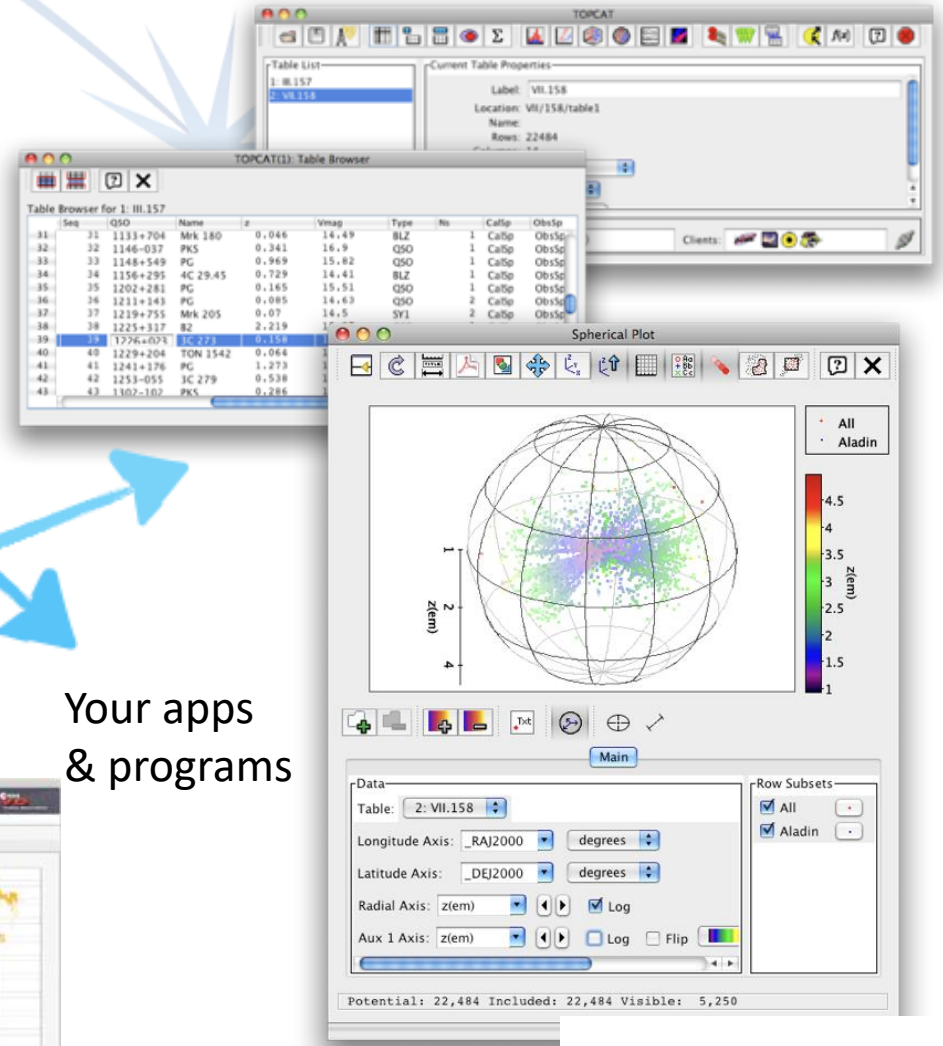


Notebooks

Your apps
& programs



Spectral tools



TOPCAT

Broadcast

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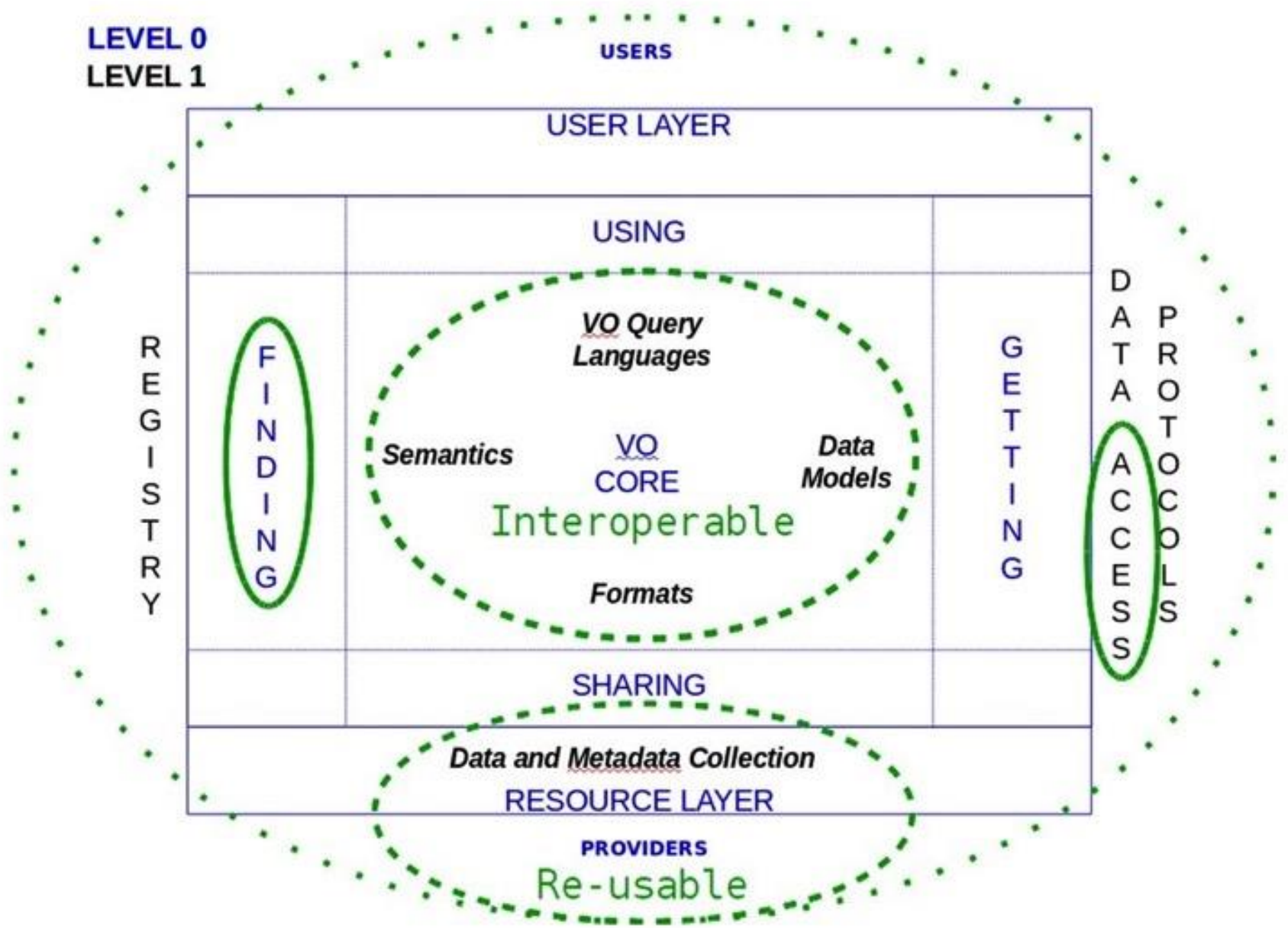
VO is FAIR



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ESCAPE in a nutshell

ESCAPE convenes a large scientific community

- **31** partners : **7** ESFRI & landmarks: CTA, ELT, EST, FAIR, HL-LHC, KM3NeT, SKA
- **2** pan-European International Organizations: CERN, ESO (with their world-class established infrastructures, experiments and observatories).
- **4** supporting ERA-NET initiatives: HEP (CERN), NuPECC, ASTRONET, APPEC
- **1 involved initiative/infrastructure: EURO-VO (Virtual Observatory)**
- **2** European research infrastructures: EGO and JIVE-ERIC
- Budget: **16 M€,** Started: **Feb 2019**, Duration: **42** months
- Coordinator: **CNRS (**Centre National de la Recherche Scientifique**)**

Home page: https://projectescape.eu

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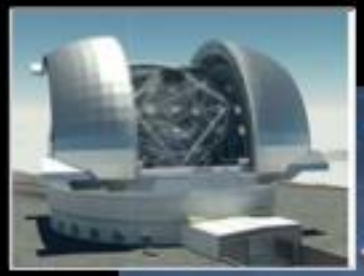
ESCAPE
European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures

Radio

JIVE-VLBI

SKA

Visible light

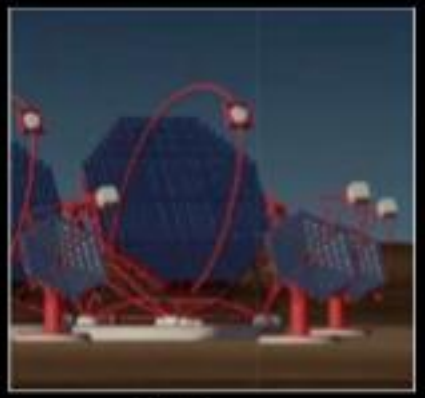


ELT

ESO

EST

Gamma rays



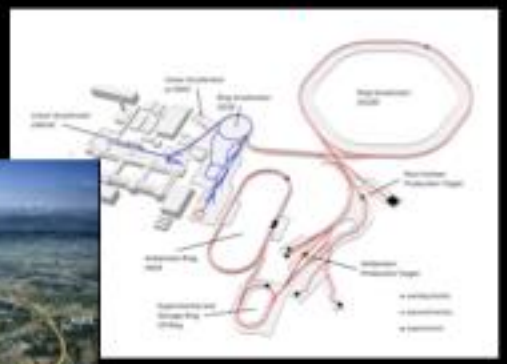
CTA

Accelerator-based
Particle Physics

HL-LHC

CERN

Accelerator-based
Nuclear Physics

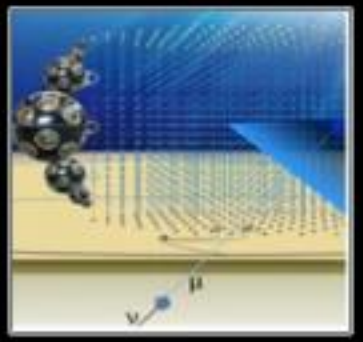


FAIR

Gravitational Waves

EGO-VIRGO

Cosmic-rays
Neutrinos



KM3NeT

ESCAPE goals

1. Implementing **Science Analysis Platforms** for EOSC researchers to stage data collections, analyse them, access ESFRIs' software tools, bring their own custom workflows.

2. Contributing to the **EOSC** global resources federation through a Data-Lake concept implementation to manage extremely large data volumes at the multi-Exabyte level.

3. Supporting **"scientific software"** as a major component of ESFRI data to be preserved and exposed in EOSC through dedicated catalogues.

4. Implementing a community foundation approach for continuous software shared development and training new generation researchers.

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

6. Further involving SMEs and society in knowledge discovery.

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Connecting ESFRI to the EOSC via the VO

In practice: ESFRI-VO-EOSC connection

- Inclusion of **VO registry** will be a key factor
- Implement **FAIR principles via interoperability standards**
- **VO next-steps:**
  - Requirements of ESFRI and European data providers, e.g. value added data at ESO, preparing for Big Data
  - Connection to computing, and extension to new communities
- **Stewardship** – technical and human
- **Training** – ”Interoperable data schools”

Following all steps of EOSC evolution – making the connection with VO and astronomy needs

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CEVO: Connecting ESFRI to the EOSC via the VO

EOSC – VO – ESFRI connections : main themes of Open Science and implementing FAIR

- **Activities associated with IVOA standardization**
- **Training "schools" for early career researchers**
- **Workshops for data providers**

CEVO work package partners: Lead by

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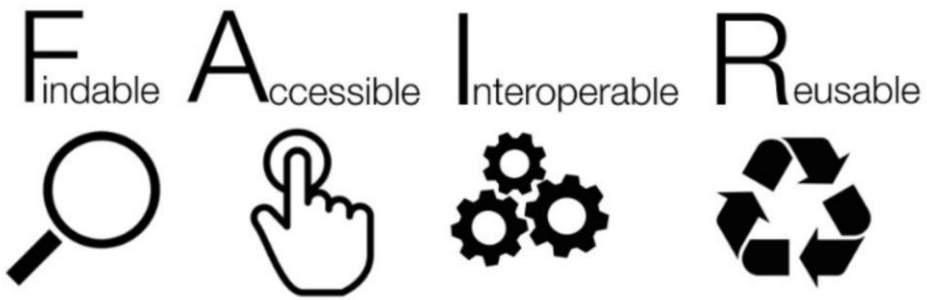
Thanks….

…and please visit the CDS booth to get information on making your data FAIR at CDS:



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