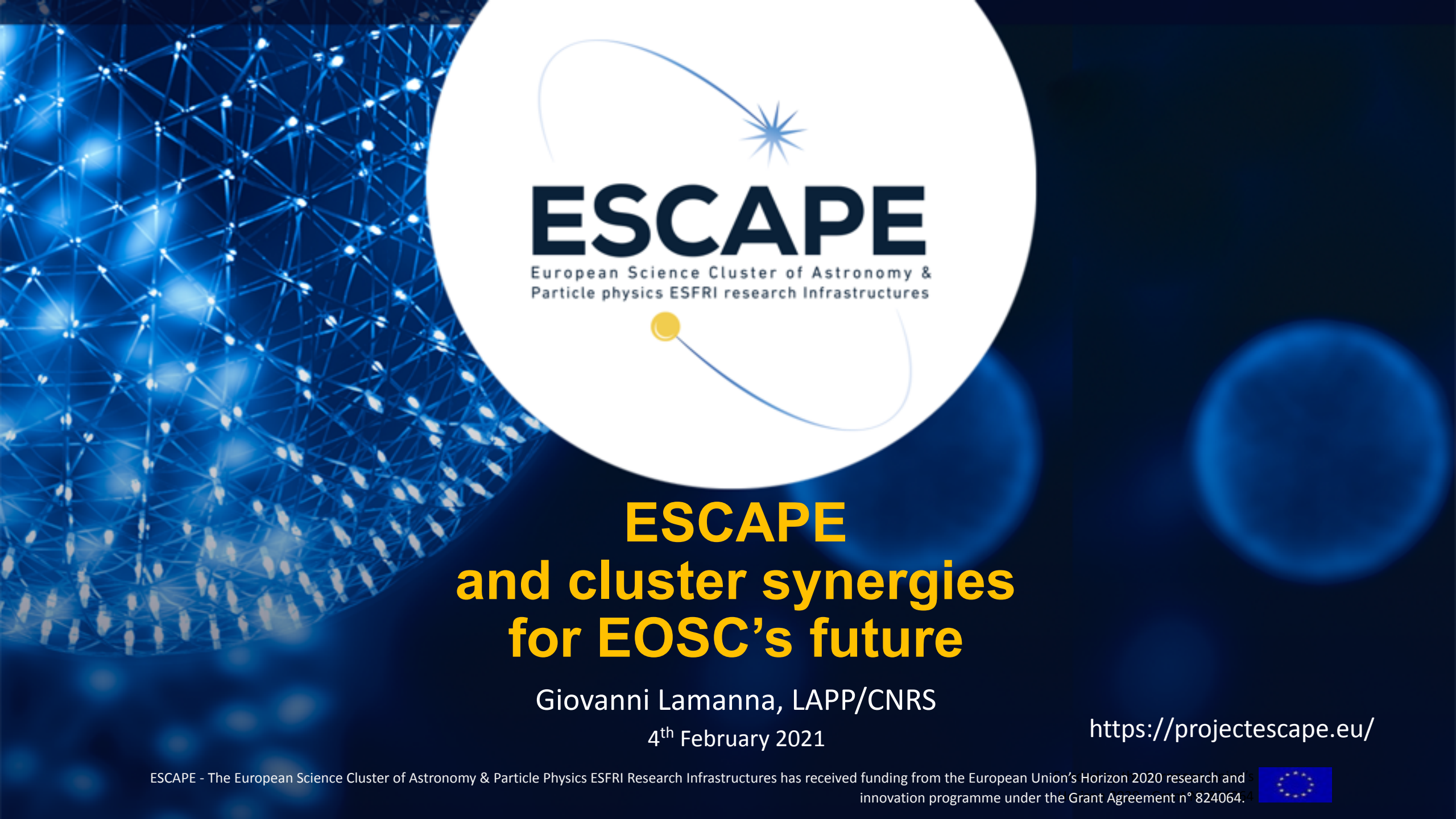


ESCAPE and cluster synergies for EOSC's future

Giovanni Lamanna, LAPP/CNRS

4th February 2021

https://projectescape.eu/

ESCAPE - The European Science Cluster of Astronomy & Particle Physics ESFRI Research Infrastructures has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement n° 824064.

Outline

- ESCAPE background, context and project work programme
- The cluster action, synergies and EOSC Future
- The Science Clusters vision and role for the future

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

ESCAPE

European Science Cluster of Astronomy &
Particle physics ESFRI research Infrastructures

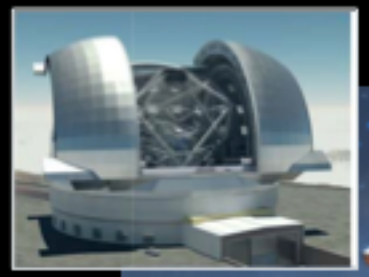
Funded by the European Union's
Horizon 2020 - Grant N° 824064

Radio

JIVE-VLBI

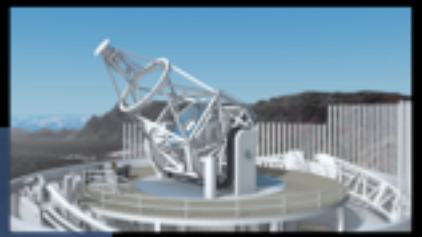
SKA

Visible light



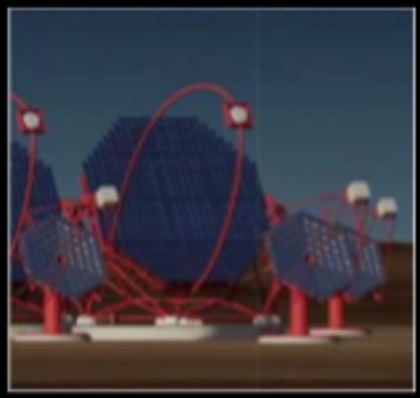
ELT

ESO



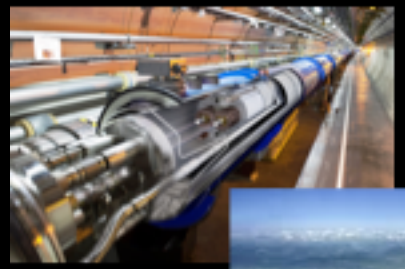
EST

Gamma rays



CTA

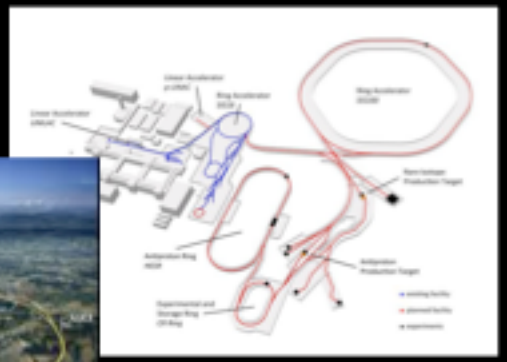
Accelerator-based
Particle Physics



HL-LHC

CERN

Accelerator-based
Nuclear Physics

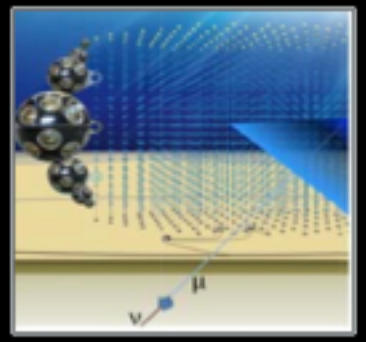


FAIR

Gravitational Waves

EGO-VIRGO

Cosmic-rays
Neutrinos



KM3NeT

ESCAPE: Astronomy and Particle Physics ESFRIs

Background analysis for the uptake of “Open Science” and “Data FAIRness”

- Builds on communities’ complementary excellences in data stewardship:
  - Astronomy Virtual Observatory infrastructure
  - HE-NP expertise in Exabyte-scale data management and large-scale distributed computing
- Builds on existing inter-RI synergies, intersections.
- Recognises that ESCAPE communities will be Exascale data generators, early adopters of ICT and data management innovations, push state-of-the-art.
- Both Observatory- and Facility- operations require global, open access to data, long term curation, and sustainability.

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

ESCAPE consortium

- **31** partners (including 2 SMEs)
- **7** ESFRI projects & 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).
- **2** European research infrastructures: **EGO** and **JIV-ERIC**

Formal commitment of their legal entities and management boards required by EC

- **1** involved initiative/infrastructure: EURO-VO
- **4** supporting European consortia: APPEC, ASTRONET, ECFA and NuPECC.

- Budget: **15.98 M€**
- Started: **1/2/2019**
- Duration: **48** months (end date 31/1/2023)
- Coordinator: **CNRS-LAPP**

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

ESCAPE consortium

As per H2020 INFRAEOSC-04-2018 call - CLUSTER MEMBERSHIP and PARTNERSHIP:

- *The EC funding contributions **proportional to the number** of pan-European research infrastructures **(ESFRI project/landmark)** that the science cluster connects to the EOSC.*

- Each **RI legal entity commits** together with a sub-set of associated national stakeholders.

Furthermore*:*

- The Director of each ESFRI RI is a member of the **ESCAPE Supervisory Committee (E-SC)**

- APPEC, ASTRONET, ECFA, NuPPEC chairs and ESA representative form the **ESCAPE External Advisory Board (E-EAB)**

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

ESCAPE Work Programme

Data Lake:

- Build a scalable, federated, data infrastructure as the basis of open science for the ESFRI projects within ESCAPE. Enable connection to compute and storage resources.

Software Repository:

- Repository of "scientific software" as a major component of the “data” to be curated in EOSC. Implementation of a community-based approach for the continuous development of shared software and for training of researchers and data scientists.

Virtual Observatory:

- Extend the VO *FAIR* standards, methods and to a broader scientific context; prepare the VO to interface the large data volumes of next facilities.

Science Platforms:

- Flexible science platforms to enable the open data analysis tailored by and for each facility as well as a global one for transversal workflows.

Citizen Science:

- Open gateway for citizen science on ESCAPE data archives and ESFRI community

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

WP interactions: full stack – the ESCAPE EOSC cell

Promoting, implementing and committing in **Open Science**

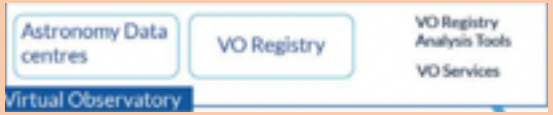
ESCAPE OSSR | Open-source Scientific Software and Service Repository

Catalogue & Repository of resources

Datasets
Software & services
Tutorials
Training
Publications

ESCAPE VO | Virtual Observatory

Virtual Observatory



TSP's

RI-Specific Science Platforms

ESCAPE SAP | Science Analysis Platform

Science Platforms

Workflows, notebooks, deployment platforms, packaging

ESCAPE CS | Citizen Science

Citizen Science

Data Lake

FAIR data management
Content discovery and delivery

ESCAPE DIOS | Data Infrastructure for Open Science

GÉANT

HPC

PRACE
EuroHPC Joint Undertaking

HTC

Grid clusters, etc

Private/public clouds

Commercial clouds

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

Some considerations about the “Science Clusters”

- “Cluster” is the most successful (network) tool that the European Commission has ever proposed, thanks to indispensable ingredients: **network + funding + focus + high-level commitment + coherence with European policy + multi-disciplines + bottom-up researchers’ involvement + training.**
  - Science clusters (within the EOSC Association) to build a coordinating structure;
  - Physicists together with data-scientists, researchers in computer science and digital SMEs.
  - Virtual Research Space for open science, R&D and open data uptake.

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

Some considerations about the “Science Clusters”

- The workprogrammes of the Science Clusters are evolving

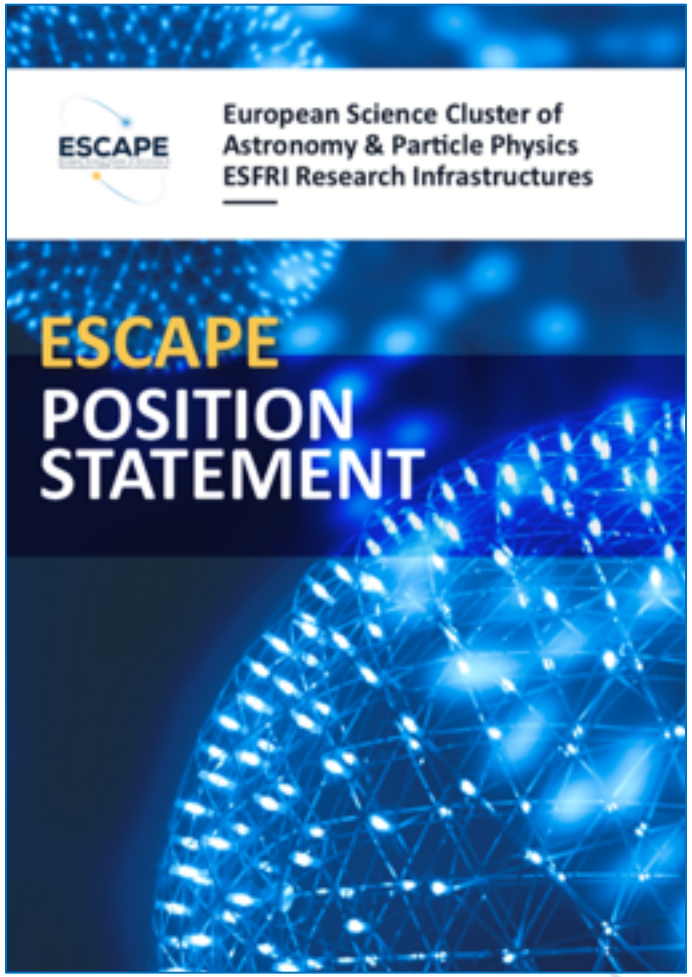
Main implications and requirements:

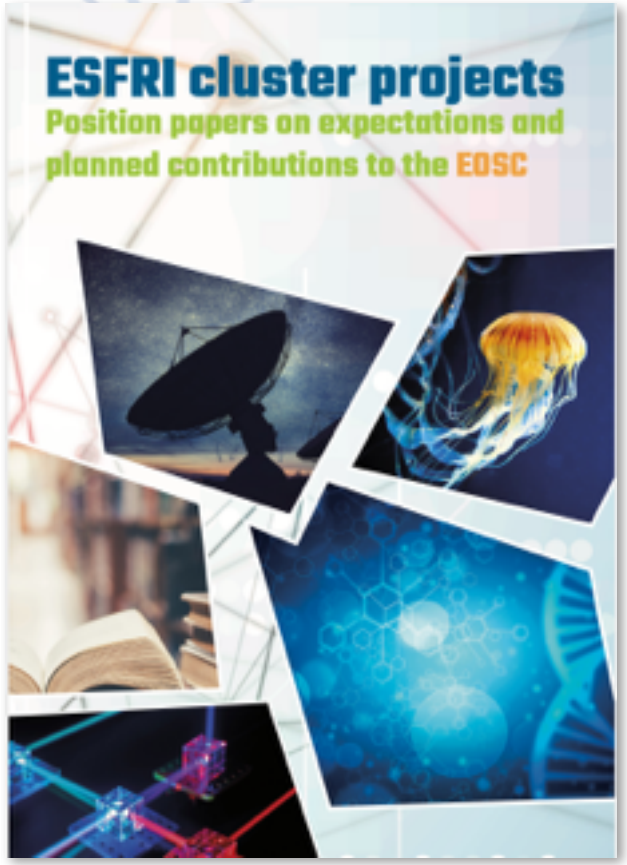
1. supporting synergies (strong inter-clusters dialogue towards a shared vision)
2. enhancing researchers’ participation in EOSC
3. leveraging synergies, reaching new communities and more Research Infrastructures (RI)
4. prospecting future commitments and role

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

1. Broader synergies with other research clusters

Gathering the contributions from all RIs Directors (E-SC)





Five thematic Science Clusters founded under INFRAEOSC-04-2018 (80% of ESFRI RIs)

https://zenodo.org/record/4044010#.X2oaYtaxVcs

https://zenodo.org/record/3675081#.X2R2PJNLhTY

https://www.projectescape.eu/sites/default/files/Escape_position_statement_web.pdf

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

2. Enhancing researchers' participation in EOSC

Test Science Projects (TSP)

TSPs originally part of the ESCAPE work programme, proposed to validate ESCAPE services for Open Science at the end of the project.

The ESCAPE-TSP concept finds consensus and evolves for a larger impact.

- Based on communication and shared plans with ESFRI-EOSC task force, EC and other Science Clusters.
- Stimulating and/or cooperating with Joint ECFA, NuPPEC, APPEC Activites (JENAA)
- TSP "bench" concept is now in all clusters aiming at enhancing researchers participation in open science and cross-domain scientific research (and guide the EOSC architecture).
- Included by all five Science Clusters in the H2020- EOSC03 EU proposal ("EOSC Future") (*proposal successful and Grant Agreement in preparation …)*

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

2. Enhancing researchers' participation in EOSC

- TSPs are proposed to demonstrate multi-domain science integration across ESCAPE
  - demonstrate new cutting edge open science capabilities, making use of the services implemented within ESCAPE
  - feedback on the capabilities delivered by ESCAPE
  - benefit real science goals in exploring synergies between the ESFRIs and largely among three scientific communities Astrophysics/Astroparticle, accelerator-based Particle and Nuclear Physics (supported by consortia of EU member states research agencies and institutes within JENAA)

A top-down endorsement for a bottom-up approach based on Expression of Interests (EoI) subscribed by researchers

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

2. Enhancing researchers' participation in EOSC

Dark Matter TSP:

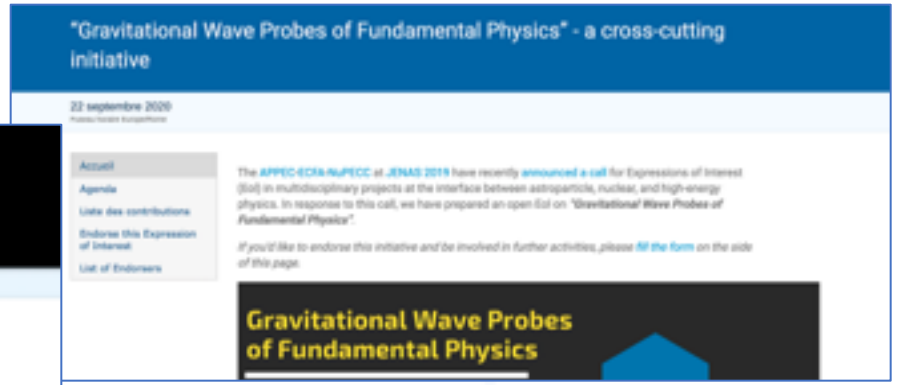
- understand the nature of dark matter by collecting data, analysis pipelines and results from complementary astronomy, particle and nuclear physics sources on a broad platform that will be ultimately be hosted on the EOSC Portal.
- exploit synergies and complementarities across different communities, creating a unique link between dark matter as a fundamental science question and the Open Science ESCAPE services needed to answer it.

Extreme Universe & Gravitational waves TSP:

- do 'frontier' multi-messenger science to understand extreme matter and particle processes in strongly curved space-time.
- combine astronomy and e-infrastructures and focus on data organisation
- organise data from different wavelengths/messengers - and different types of extreme astrophysical transients (SNe, GRBs, FRBs, TDEs) - so that they can be easily gathered, analysed and modelled holistically, and not remain fragmented as present.

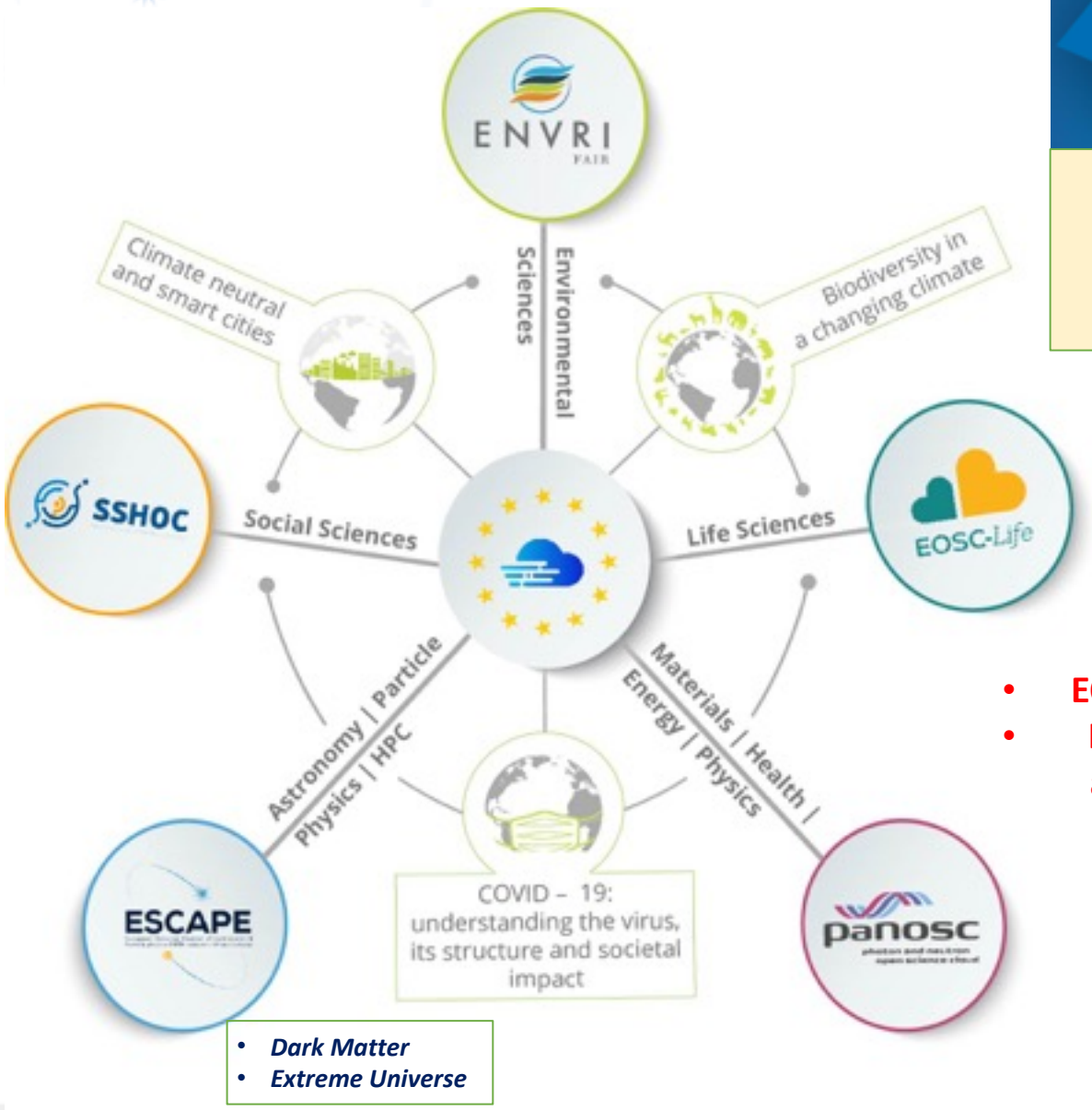
Linked to two corresponding JENAA EoIs (with already about 1000 subscribed scientists)

A bottom-up approach !



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

- **Integration of Community Services and Products**



- ***Dark Matter***
- ***Extreme Universe***

EOSC FUTURE

Synergy between
Science Clusters
&
e-infrastructures

- **EOSC Service Delivery**
- **Innovation capacity and procurement**

- **Architecture and Interoperability**
- **Design and Development of Portal Layers**
- **Training and Skills**

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

3. Leveraging synergies, reaching new communities and more RIs

ESCAPE Innovation Capacity and Procurement

- Co-developments with digital SMEs, e.g.
  - ➢ **Wavefier**: real-time Machine Learning Classifier for transient signals in Gravitational Waves
  - ➢ **Gamma-Learn**: real-time Machine Learning pipeline for Gamma-ray astronomy
  - ➢ Combining ESCAPE with European Regional Development Fund programme (*ex. cooperation, training and innovation schemes for Society and Economy - IDEFICS @ LAPP)*
  - ➢ Leveraging industrial ICT cooperation schemes (within ESCAPE ESFRI RIs)
- ESCAPE results and actions for Open Science are reaching out (ex. Discussions in progress with ASTRI, DUNE, GANIL-SPIRAL2, FCC et al.) and becoming global (e.g. USA, Japan, etc.)

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

4. Prospecting future commitments and role of Clusters

Outlook into the future (e.g. Horizon Europe) :

ESCAPE community proposals for EOSC connections with the Common European Data Spaces.

- ➢ ***Industrial (manufacturing), health and skills data space***
- ➢ ***Green deal and Energy data space***

- A certified open archive to be exploited by any new Big Science research facility (e.g. FCC) to share innovation, practices and methods **about energy/water/heat management, environmental protection, etc**.
- Any digital object from R&D and innovation works within the ESCAPE community should be *FAIR* and accessed from a single catalogue (ex.: Solid-state detector legacy data; co-creation with industries data; interdisciplinary nuclear physics application; new paths on electronics and quantum technology)

[…]

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

4. Prospecting future commitments and role of Clusters

- "Science Cluster" scheme is a potential model of "coordinating structure", because it combines the top-down (as for the ESCAPE-SC) and bottom-up (thanks to JENAA community consultations) approaches.

- Disciplines are getting organised often leveraging the corresponding "Science Cluster" towards an ERIC, a League or building a thematic "Community platform RI".

- In general : Clusters' role as "Community Platform RI" shaping EOSC, to establish a shared view, focus on next challenges together in EU, also bridging with other "clusters" […]

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

Summary

- ESCAPE brings together Astronomy, Astrophysics, Astro-Particle, High Energy and Nuclear Physics communities
  - Common interests in Exabyte-scale FAIR data management and open science
  - Objectives are science-driven (multi-messenger/multi-probe key approach) as well as commonality and synergies across infrastructure, services and tools.

- Broader synergies within a large scientific community and for innovation/society
  - Synergies with different EOSC projects
  - Facilitate or follow up high-level cooperative agreement among flagship RIs
  - Test Science Projects (TSP) to enhance researchers commitment in Open Science and building EOSC by focusing on transdisciplinary scientific objectives
  - Committing in and leveraging ESCAPE for industrial engagement in the future

- Broader synergies with the other Science Clusters , e-infrastructures for EOSC
  - All acting in concert towards the EOSC – aligned goals and common interests across a broad range of European Research actors
  - Leveraging the Science Clusters towards “Community platform Research Infrastructures”

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

Thank you!

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