The Astrophysics Centre for Multimessenger studies in Europe (ACME)

An answer to the HORIZON-INFRA-2023-SERV-01-02 call

Research infrastructure services advancing frontier knowledge

2 Workshops from a series already organized by APC and EGO, with support from APPEC, AHEAD2020, INP23, EGO

Low-latency alerts and Data analysis for Multi-messenger Astrophysics – 13, 14 Jan 2022

- Focused on developments from a data analysis perspective.
- Contributions and report to be found here: https://indico.in2p3.fr/event/25290/

Multi-messenger Astrophysics Workshop

10-12 Oct, 2022, Cascina

- Focused on future RI developments
- A day dedicated to the call with working groups,

with Astronomy and Astroparticle communities

- Contributions here: https://indico.ego-gw.it/event/199

The HORIZON-INFRA-2023-SERV-01-02 call

This topic aims at providing trans-national access (on-site or remote) and/or virtual access to integrated and customised RI services for curiosity-driven research. One of the 3 eligible scientific domains is Astronomy and Astroparticle physics. The EU contribution per project is up to 14.5 million euros. The deadline for submission is March 09, 2023.

Expected outcomes:

1- wider, simplified, and more efficient access to the best research infrastructures available to researchers to conduct curiosity-driven research, irrespective of location;

2- breakthrough and leading-edge research enabled by advanced research infrastructure services made available to a wider user community;

3- improved and harmonised RI services and broader use of RI resources across Europe deriving from the exploitation of synergies and complementarities;

4- a new generation of researchers trained to optimally exploit all the essential tools for their research;

5- cross-disciplinary fertilisations and a wider sharing of information, knowledge and technologies across scientific fields fostered by closer interactions between researchers active in and around research infrastructures;

6- better management, including implementing FAIR data principle, of the continuous flow of data collected or produced by research infrastructures.

The Astrophysics Centre for Multimessenger studies in Europe (ACME)
- an overview -

An answer to the HORIZON-INFRA-2023-SERV-01-02 call

ACME aims to bridge the astroparticle and astronomy communities and create a coordinated network, by providing wider access to users to the complementary and synergetic infrastructures' data and expertise, and by lowering the entry barrier for neighboring yet complementary science fields.

- CNRS offered to coordinate
- Coordinator: Antoine Kouchner

Discussions with the future consortium:

- 2 APPEC meetings with key players on August 30 and October 4, 2022
- MMAW workshop (see slide 2): 10-12 October 2022 at EGO
- 35 RIs from AP and Astronomy have been contacted (radio, optical, X and gamma-rays, CR, neutrinos, GW), also several platforms for data analysis and brokers

The Astrophysics Centre for Multimessenger studies in Europe (ACME)
- a short description-

Direction 1 (Outcome 1): Multi-messenger and time-domain observations of extreme astrophysical events -TNA access

- For simultaneous observations with multiple observatories, each of them with different capabilities in terms of source localizations, two options are possible: a monitoring program or a Target of Opportunity (ToO) observation type. Both types of observations will be proposed by ACME, using specific calls.

- An ACME Time Allocation Committee (TAC), composed of experts from each community and each involved infrastructure, will evaluate the proposals and select them based on scientific excellence.

- The selected proposals will be sent to the research infrastructures that best fit the criteria of the requested program, for observation and/or real-time data access scheduling, respecting, if mandatory, their individual procedures and access policies.

Example of deliverable: XX units of TA access to YY infrastructures

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- a short description-

Direction 2 (Outcomes 2, 4 and 5): Provision of scientific expertise – TNA access

- The preparation of observations and the multi-messenger data processing, analysis and interpretation require specialized scientific knowledge.
- A user program built on the analysis of raw data or data products from different sources and with different calibrations will require expert knowledge and support from different research fields and/or different observatories, astronomical telescopes and astroparticle detectors.
- The access to these expert programs will be based on a selection process following a call for proposals, in accordance with the TNA access rules.

Example of deliverable: XX expert hours from YY infrastructures

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Direction 3 (Outcomes 1, 2, 3, 5 and 6): Provision of improved access to archival and near real-time data – VA & TNA accesses

- ACME will setup the VA online data analysis services for most of the involved telescopes / detectors and integrate them into the EOSC, starting from prototypes for multi-messenger services,

- The services will be FAIR in the sense that it will be possible to combine analysis of different telescopes and detectors in multi-messenger data analysis workflows

- TNA services will include help for archival data analysis needed for observational proposal preparation to study data from various facilities in multi-messenger context. Assistance for interpretation and modeling could also be requested though dedicated ACME Calls for expert advice on the quality and limitations of high-level data products of different instruments, telescopes and detectors, covering all ranges from products for the non-expert user to expert-level analysis details.

Example of deliverable: XX units of VA from YY infrastructures
Example of deliverable: a harmonised online data analysis interface for finding, accessing and re-analysing telescope and detector data, tailored to multi-messenger science use-cases

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- a short description-

Direction 4 (Outcomes 1, 2, 3, 5 and 6): Improved coordination for real-time detection of transient events and low-latency alert management

- ACME will provide the possibility to integrate the systems of individual telescopes / detectors into a common platform that will provide alert management / filtering and decision-making activities in real time (alert generation and follow-up observation planning), status of observations, availability of data and other relevant information and data.

- To integrate the observation scheduling improvement and the alert distribution management into a common tool approved by the facilities and best serving the end users, we will take a pro-active approach, starting from real use case hypotheses, in order to identify at each step of the workflow, from the science case and observation till the data analysis and publication, what is currently needed and explicit the best solution to be implemented.

Example of deliverable: A minimum viable product platform for multi-messenger information and resources, improving the preparation of follow-up observations and data analysis

Example of deliverable: Improved low-latency alert management and observation scheduling: Easier access, extended streams and improved coordination of all participants of the "European real-time alert distribution network" (brokers team)

The Astrophysics Centre for Multimessenger studies in Europe (ACME)
- a short description-

Direction 5 (Outcomes 4 and 5): Training workshops, schools and hackathons for scientists and engineers

- We will set up training programs and organize regular thematic events to provide the best knowledge and practices, on broad topics and also tailored to specific needs. Special attention will be paid to the methodology of the training programs and the creation of persistent training material using up-to-date technologies, so that the trained scientists and engineers will be able to train others in their communities based on the knowledge acquired during the workshops and schools.

Examples of deliverables: events like workshops, summer schools, hackathons, training material

Transversal directions: Societal and environmental impact, communication and dissemination

- Communication will be carefully thought to reach as many people as possible. Infrastructures that collect data for other disciplinary fields, such as marine biology and atmospheric monitoring, can contribute to the environment and biodiversity preservation programs.

The Astrophysics Centre for Multimessenger studies in Europe (ACME) - examples of Announcements of Opportunities (AOs)-

1) AO for time of observation

2) AO for expert use of the observatory produced data in relation to other observatories (subthreshold)

3) AO for training of other observatory experts to the specific observatory produced data

4) AO for use of the environmental data of the observatory

The Astrophysics Centre for Multimessenger studies in Europe (ACME)
- next steps-

- We have already received Expressions of Interest from several infrastructures and platforms on going discussions with the others

- Working on detailing the proposal and the Work Packages

- A kick-off meeting to be organized beginning of January 2023