1ˢᵗ ASTERICS-OBELICS Workshop

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LAPP-IN2P3-CNRS

Rome, 12-14 December 2016

ASTRONOMY and ASTROPARTICLE

<u>During the last decade</u>:
* intensive construction of large astroparticle physics experiments and detectors.
* new perspectives in Astronomy and new infrastructures in preparation.

<u>Towards the end of the decade</u>:
* the projects passed from the noise hunting regime to the generation of large sets of data. Data production needs large computing resources, intensive simulation and large storage space.
* multi-messengers data need formats, software and services for wide accessibility and effective mining.
* The computing and data models of future research projects rely on deployment of scalable, distributed non-homogeneous resources and need to be built upon the state of the art ICT and adaptable and evolving workflow management systems.
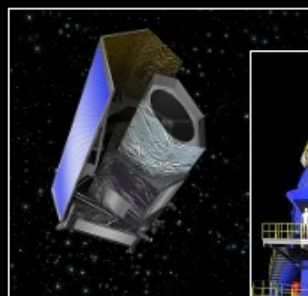
Radio   Infrared   **Visible light**   X-rays   **Gamma rays**
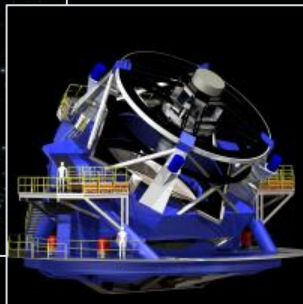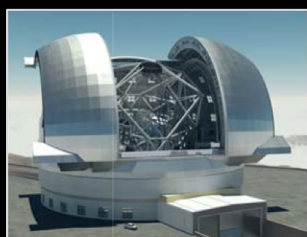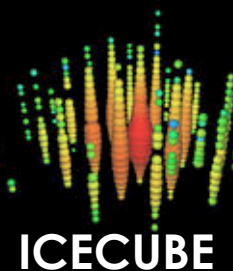
LOFAR

EUCLID

LSST

HESS

SKA

E-ELT
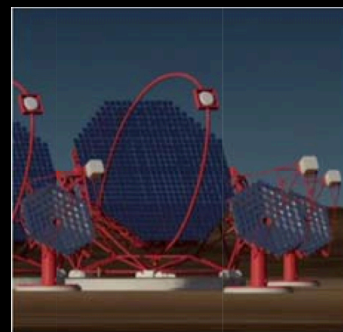
CTA

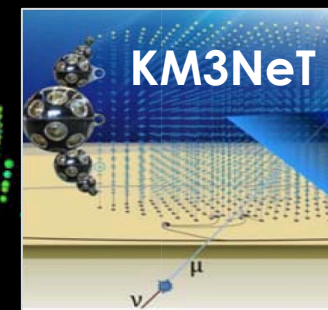**Gravitational Waves**   Cosmic-rays **Neutrinos**

KM3NeT

LIGO & VIRGO

ICECUBE

Commons and cooperation:

ASTERICS

Astronomy ESFRI & Research Infrastructure Cluster
ASTERICS - 653477

- Astronomy ESFRI & Research Infrastructure Cluster

- Horizon 2020 Work Programme INFRADEV-4-2014/2015 Call – "Implementation and operation of cross-cutting services and solutions for clusters of ESFRI and other relevant research infrastructure initiatives"

- Focus of ASTERICS: SKA, CTA, KM3NeT, close links to E-ELT, EGO, EUCLID, LSST.

- Funded at 15 M€ for 4 years (1/5/2015-30/4/2019)

- 22 partners in 6 countries, representing a major collaboration in Astronomy/Astrophysics/Astroparticle Physics
ASTRON, CNRS, INAF, UCAM, JIVE, INTA, UEDIN, UHEI, OU, FAU, VU, CEA, UVA, UGR, FOM, IEEC, IFAE, UCM, INFN, STFC, DESY, SURFnet.

ASTERICS overview

WP1- AMST: ASTERICS **M**anagement **S**upport **T**eam

Coordinator: M. Garret

WP2- DECS: Dissemination, **E**ngagement and **C**itizen **S**cience

Lead: S. Serjeant

WP3- OBELICS: Observatory **E**-environments **Li**nked by common **C**hallenge**S**

Lead: G. Lamanna

WP4 - DADI: Data **A**ccess, **D**iscovery and **I**nteroperability
(Virtual Observatory)

Lead: F. Genova

WP5 – CLEOPATRA: Connecting **L**ocations of **E**SFRI **O**bservatories and **P**artners in **A**stronomy for **T**iming and **R**eal-time **A**lerts.

Lead: A. Szomoru

WP3 – OBELICS

OBservatory **E**-environments **LI**nked by common **C**hallenge**S**

- The ASTERICS core work package.

- Targeting common ESFRI-projects « Data Challenges »

- Scopes:
  - Enable interoperability and software re-use.
  - Enable open standards and software libraries for multi-messenger data.
  - Develop common solutions, share prototypes, exchange experience.

- Expected impact:
  - Economies of scale and saving resources.
  - <u>Contribute to the construction and operation</u> of ESFRI projects.

Different probes/methods/specifications

Projects	Data Processing	Main requirements/challenges
EVENT-BASED (γ-rays, CR, ν) _CTA, KM3Net ..._	Evt-builder, calib. and reconstruction; reduction, real-time science.	Raw big-data. Data formats. Algorithms. On-site operation and reduction. Cooperative science tools. Observatory (A&A). Multi-λ. [...]
IMAGE-BASED (far-IR, VIS) _EUCLID, LSST ..._	Surveys/deep observation; combining photometer and spectrograph info.; Catalogue of objects.	Big-data products: data base challenges. Graphical processing, Algorithms. Images format. Catalogue preservation and query. A&A. [...]
SIGNAL-BASED (Radio, GW) _SKA, LIGO-Virgo ..._	Noise cleaning; time-series, mathematical processing (FT) converting signal in images.	Algorithms. New computing architectures and data centres. Combination of HPC and HTC. Fast soft reduction. Data mining and preservation. A&A [...]

OBELICS

OBELICS challenges in support of
ESFRI projects in Astronomy and Astroparticle Physics

Building a collaborative framework (scientists and ICT experts) and
along the data flow from observations to scientific data products.
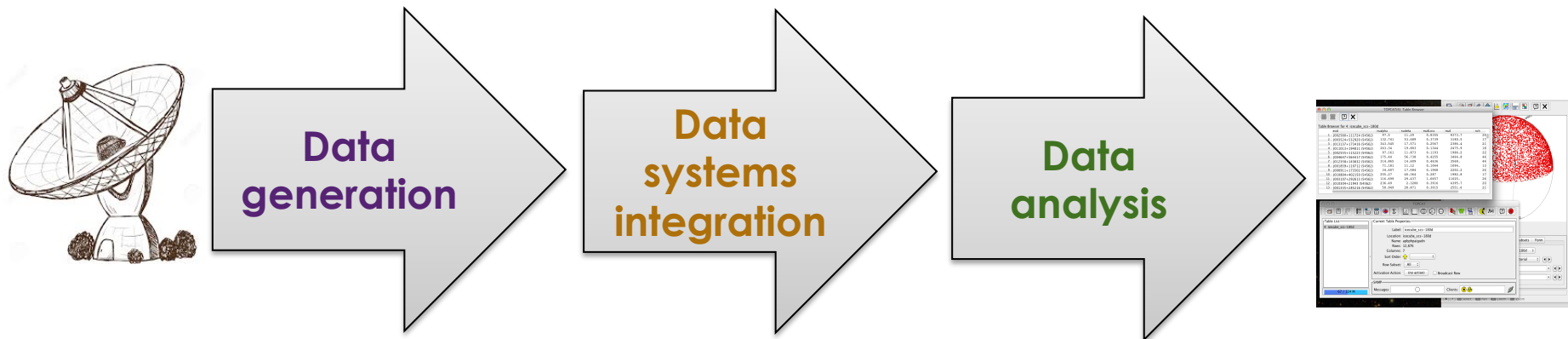
Twelve international partners cooperating around
three main steps of data pipelines
of major ESFRI and world-class projects in Astronomy.

OBELICS-structure

Task 3.1 MAUD (MAnagement, User engagement and data Dissemination)
- OBELICS mangement, project plan
- Training, **workshops**
- Industrial contracts, Science and ICT engagement

Task 3.2 D-GEX (Data GEneration and information eXtraction)
Sub-task 1: Surveying real-time or close-to-detector data streaming frameworks.
Sub-task 2: Standards on data model and data format.
Sub-task 3: Prototype libraries handling secondary data streams.
Sub-task 4: Benchmarking low-power computer platforms.

Task 3.3 D-INT (Data systems INTegration)
Sub-task 1: Coordination with e-infrastructures providers for ESFRIs specifications.
Sub-task 2: New DB technologies benchmarking and prototyping activities.
Sub-task 3: A repository of services for data workload management.
Sub-task 4: Framework/Archive system for multi-parameters metadata IRF.

Task 3.4 D-ANA (Data ANAlysis/interpretation)
Sub-task 1: Software for robust and efficient statistical analysis of very large scientific datasets
Sub-task 2: Workflow architectures on distributed computing infrastructures.

OBELICS strategy and deliverables

- OBELICS will rely on existing e-initiatives:
  - i) cooperating on technical issues with major computing data centres supporting the ESFRI projects.

  - ii) surveying available software products and services within major European e-infrastructures.

  - iii) providing use-cases to explore technical impact of new model of cloud computing for science in Europe.

1st ASTERICS-OBELICS Workshop

Astronomy ESFRI and Research Infrastructure Cluster Grant Agreement No 653477.

Science data cloud & Computing models in Astronomy & Astroparticle physics through users and e-infrastructures engagement.

Dates: 12-14 December 2016   **Venue:** Casa I CAPPUCCINI, Rome, Italy.

The 1st ASTERICS – OBELICS Workshop addresses challenges in: "Science Data Cloud & Computing models"

The Workshop programme is built around a few main topics.

For each topic we explore existing solutions and discuss potential engagements/partnerships with **Industries, Consortia, H2020 e-projects.**

Presentations of all ESFRI and world-class projects are distributed along the 3 days.

OBELICS strategy and deliverables

- OBELICS will support cooperation with industry for innovation […].

- OBELICS will organize training sessions for scientists to face the new challenges in computing and scientific software […].

OBELICS deliverables: **industrial contracts**

This workshop aims at bringing together complementary competences.

Will be key to capture these linking competences, infrastructures and innovation efforts from the industries and projects to support innovation-related objectives of ASTERICS.

Announcement:

"CALL FOR EXPRESSIONS OF INTEREST"
of ASTERICS partners for **industrial** contracts/partnerships

As a result of this call, a consolidated funding supports up to
€250,000
will be issued by from ASTERICS.

OBELICS deliverables: **international schools**

Very often our scientific software:
- only uses a small percentage of processor capabilities;
- is not professional and needs to be reengineered;
- is not adapted to evolving hardware technology and to new architectures;
- does not respond to new frameworks and interoperability requirements;
- does not scale with "big-data" mining implications.

This workshop aims at pursuing some training objectives of OBELICS and consolidating the training needs of scientists in Astronomy and Astroparticle Physics.
Needs will be further addressed in some dedicated <u>international schools</u>.

Announcement:

1st ASTERICS-OBELICS International School 2017

**"Efficient software programming
in Astronomy and Astroparticle physics"**

Conclusions

- Big-data challenges in Astronomy and Astroparticle Physics can be addressed through cross-fertilisation and shared development approach.

- The multi-wavelength scientific analyses and data-interoperability required by researchers imply important common developments.

- Synergies with Data Centres, Industries, e-infrastructures, consortia are needed in support of the implementation of ESFRI and world-class projects.

- Training initiatives for scientists involved in these challenges will help to adopt/explore new solutions.