

ASTERICS:

Astronomy ESFRI & Research Infrastructure Cluster

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Astronomy ESFRI & Research Infrastructure Cluster



ESFRI: **E**uropean **S**trategy **F**orum for **R**esearch **I**nfrastructures

what is ASTERICs?

- A €15 million Research Infrastructure funded by EC Horizon 2020 framework (2015-2019)
 - To help solve the **Big Data** challenges of European astronomy
 - To provide direct interactive access to the best European astronomy data in an international framework
 - *Cross-cutting synergies and common challenges*



ASTRON



Participating institutions



Supporting organisations and networks



addressing common challenges in astronomy and astroparticle physics

- ***supporting*** and ***accelerating*** the implementation of a new generation of observatories
- ***Focus on ESFRI projects***
- helping scientists to access data
 - ***ESFRIs+ interoperating as an integrated multi- λ , multi-messenger facility***



multi- λ , multi-messenger

- messengers: **photons, ν , grav. waves, VHE γ**

- multi- λ : 

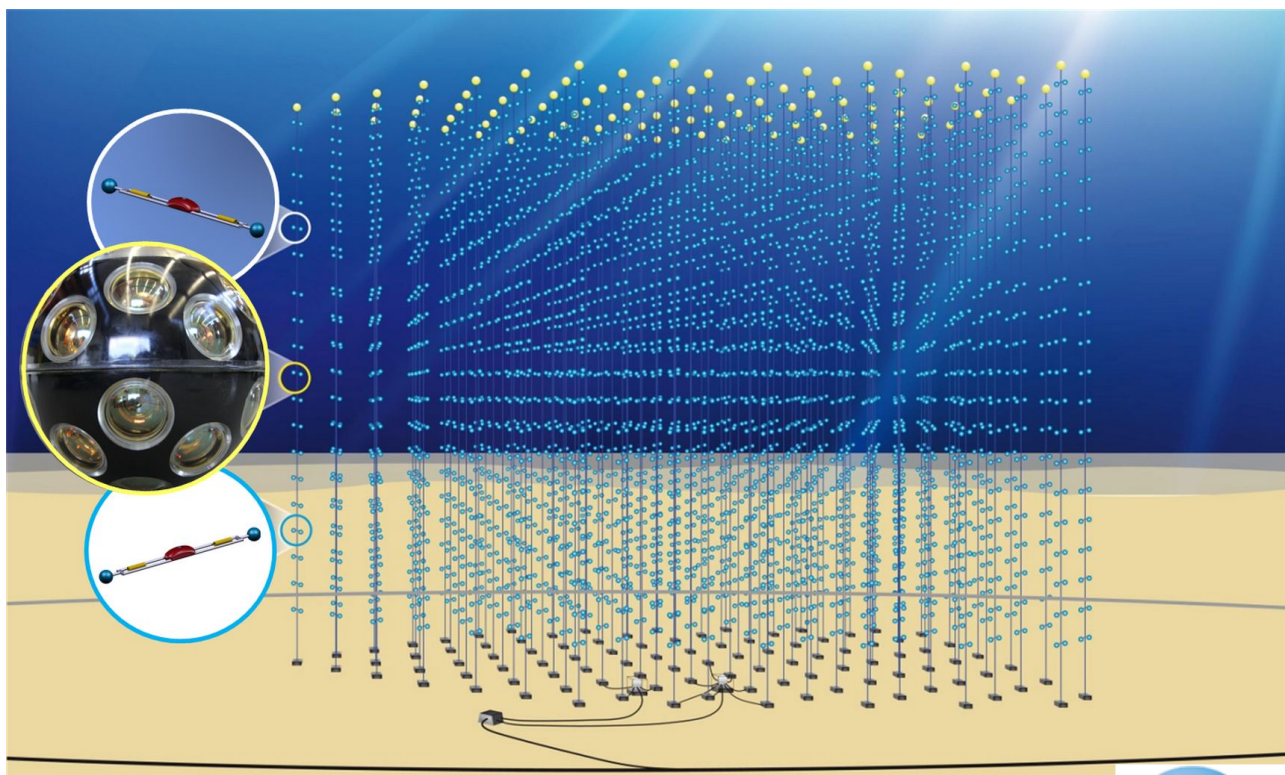
gamma ray X-ray ultraviolet visible infrared microwave radio

- transient source astronomy

To make it happen...

- Interoperability, VO, Open Data
- Scalability – processing and analysis
- Big Data, Data mining
- Streaming and timing

KM3NeT

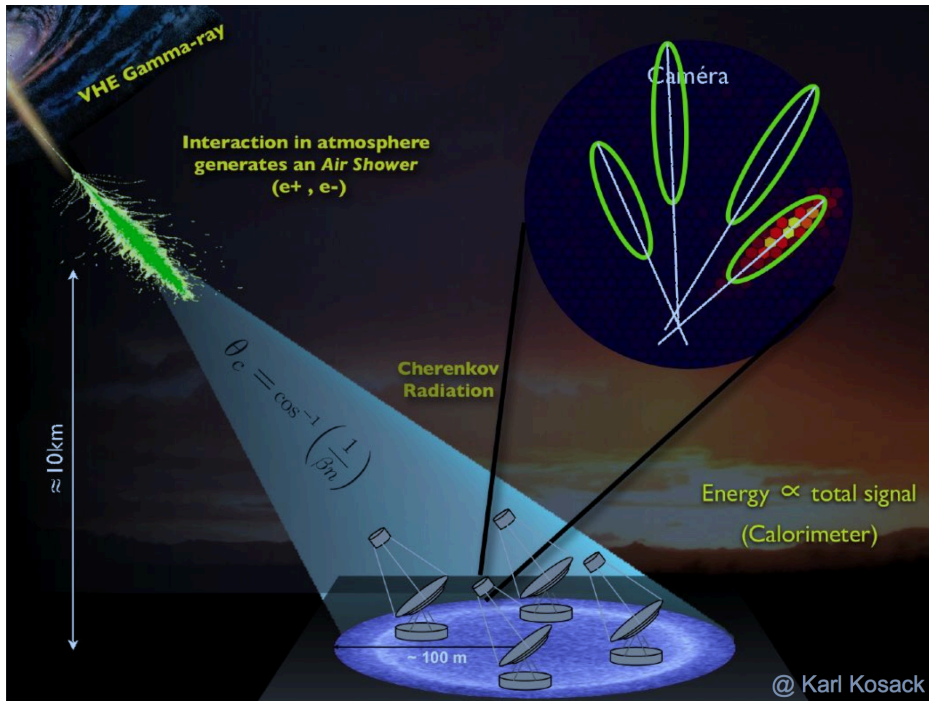


- ***A multi-km³ neutrino telescope***
- Exploring our galaxy for high energy neutrino sources
- KM3Net2 on timescale of 2020



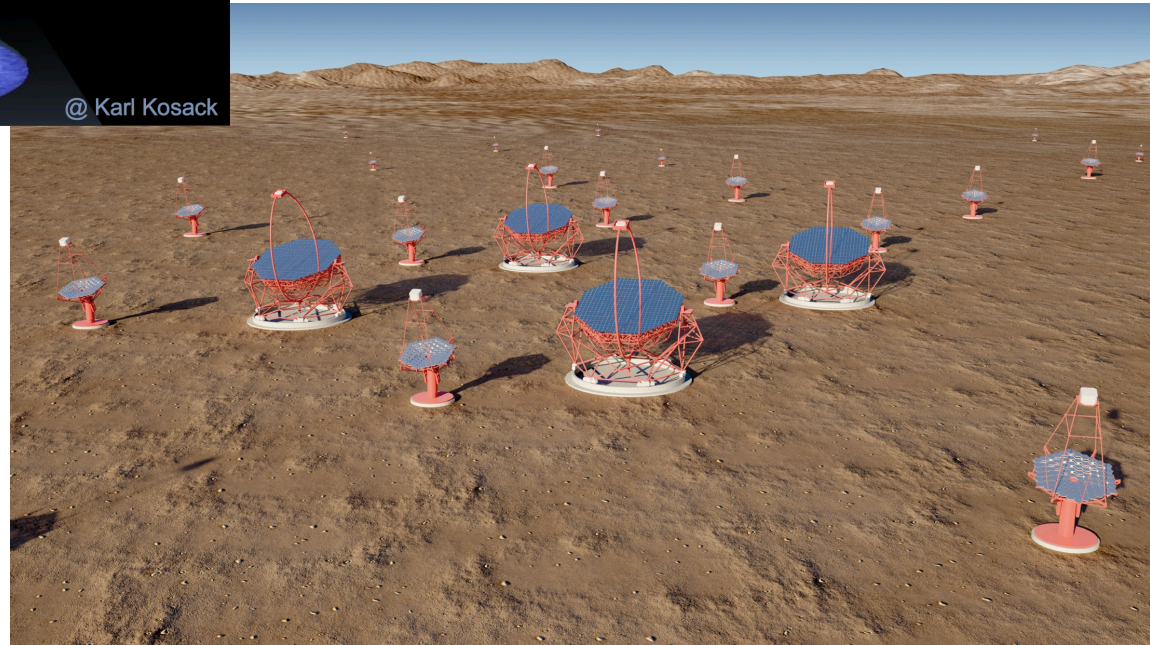
KM3NeT

Opens a new window on our universe



CTA

- Very high energy γ -ray observatory
- Event re-construction
- Streaming and processing challenges
- Precursors: MAGIC and HESS



Production phase 2018-2023



SKA-LOW, Australia

Phase 1: 130,000 dipoles over 80 km
Phase 2: 500,000 dipoles over 250 km

SKA-MID, South Africa

Phase 1: 200 dishes over 150 km
Phase 2: 2500 dishes over 3500 km

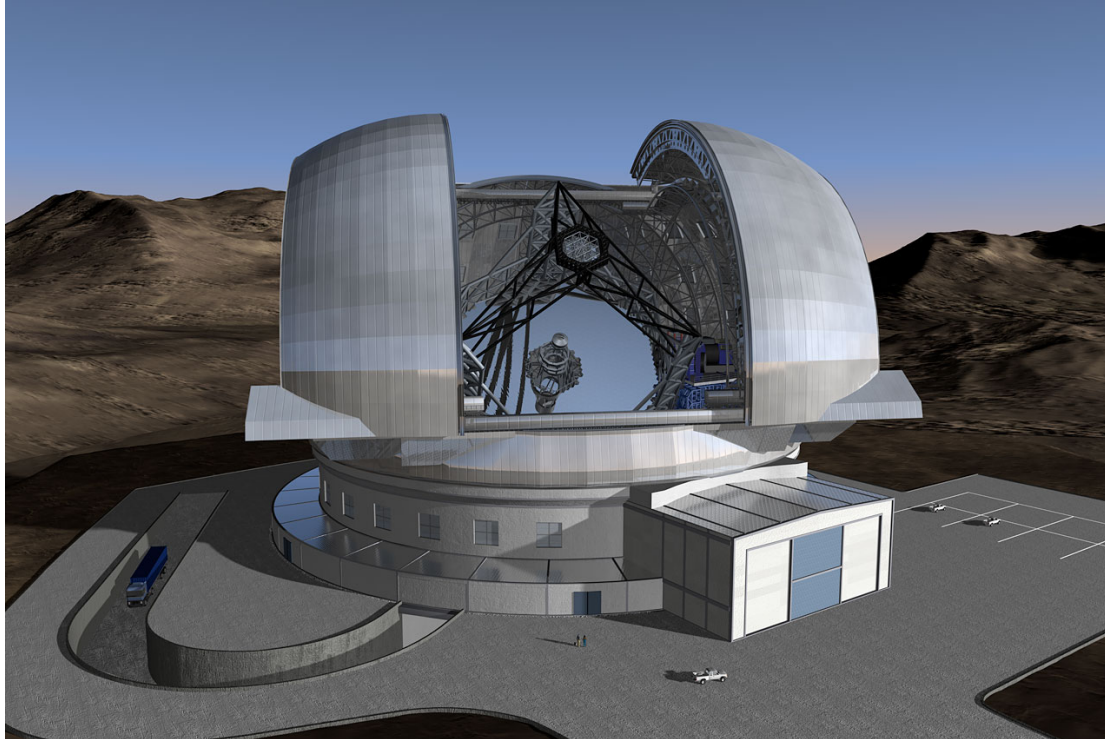
Phase 1 (2018-2023)

Phase 2 (2025-2033)

Challenges everything...



E-ELT



General purpose optical/infrared telescope

- Several scientific instruments (fast switching)

Science areas include:

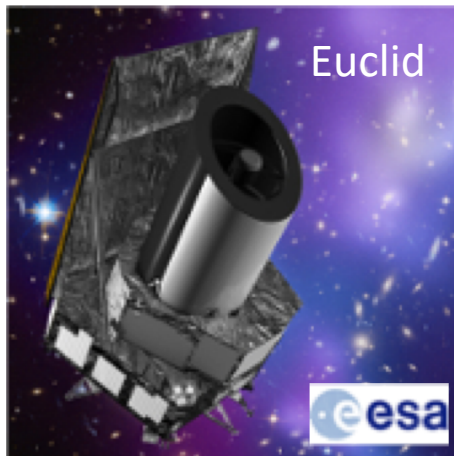
- high redshift galaxies
- star formation
- exoplanets
- protoplanetary systems



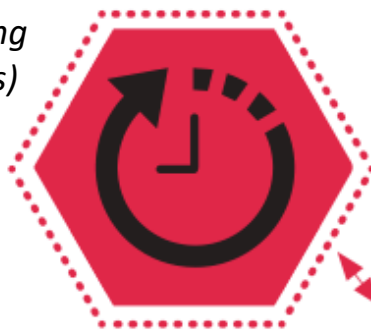
39m European-Extremely Large Telescope
First Light targeted for late 2024

Includes other world class facilities and ESFRI pathfinders

- Connecting real facilities now as path to connected future facilities



CLEOPATRA: *Connecting Locations of ESFRI Observatories and Partners in Astronomy for Timing and Real time Alerts)*



Management



DADI : *Data Access, Discovery and Interoperability*



DECS: *Dissemination, Engagement and Citizen Science*



OBELICS: *OBservatory E-nvironments LINKed by common ChallengeS*

Data Access, Discovery and Interoperability (DADI)

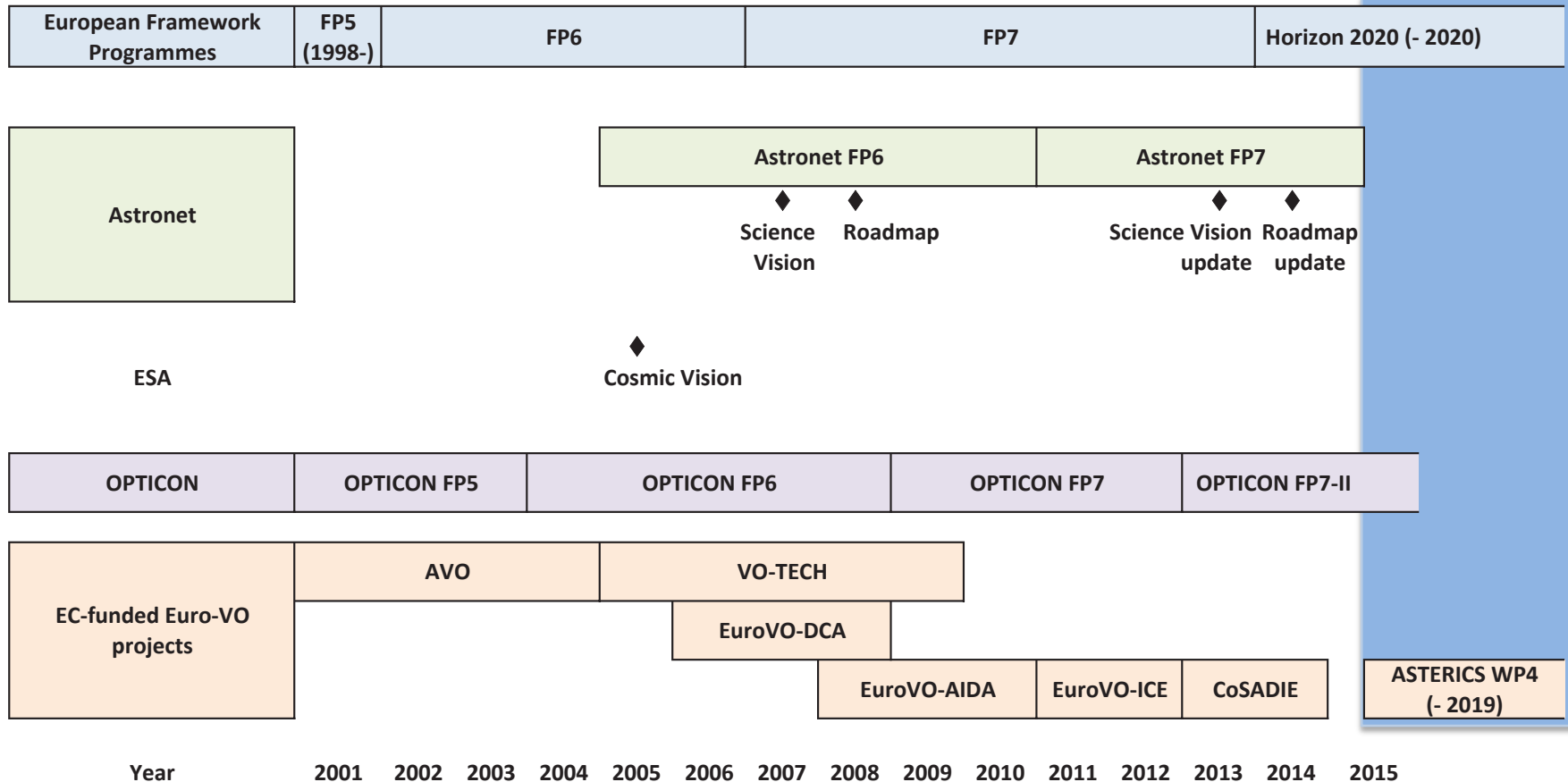
Make the ESFRI and pathfinder data available for discovery and use by the whole astronomy community

Interoperable in **Virtual Observatory framework**

- Train and support ESFRI in use and implementation of VO
- Train and support wider community in scientific use of VO
- Adapt VO framework for ESFRI needs

FR:
CDS (*Work Package Lead, F. Genova*)
Observatoire de Paris/LUTH (**CTA**)
APC (**EGO/VIRGO/ET**)
CPPM (**KM3Net**)

DADI: Building on Euro-VO, Astronet, +



ASTERICS DADI Tasks

- **The tasks address the different stakeholders of data sharing policy :**
 - **Research Infrastructures: IRs/ESFRIs**
 - **Science community**
 - **Data sharing framework developers (VO partners)**

ESFRI, pathfinders and other infrastructures

- **4.1** Support ESFRI, pathfinders other infrastructures of pan-European interest for implementation of their data in the VO framework
 - 4 Forum and Training events
 - European Astronomy Data Provider forums
 - ESFRI forums and training events
 - Detailed exchange of requirements and feedback, and problem solving

Science community

- **4.2** Train and support the astronomical community in scientific use of the framework

4 VO Schools

Re-usable materials

Feedback and requirements



Data sharing framework developers

- **4.3** Adapt the VO framework for ESFRI needs based on feedback and requirements

- Priority Areas:

- Multi-dimensional data

- First set of IVOA standards now established, and feedback and further requirements in coordination with radio astronomy partners

- Time Domain Astronomy – VOEvent, Time series in preparation for new era of transient event astronomy

- High Impact : HiPS and MOC for innovative and scalable access and use of All-sky data





ASTERICS DADI connections: gravitational waves

ASTERICS fostered
use of VO for grav
wave EM follow-up

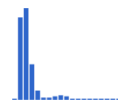


Skymap Viewer

A sky atlas for understanding LIGO-Virgo skymaps. Help [here](#), or watch a [video about Skymap Viewer](#). Plenty simulated skymaps [here](#). If you do not see the big dark sky map, look below and widen your browser. Zoom with the + and - at the right of the sky.

LIGO-Virgo Skymaps

This is skymap
GW150914:LALI.
50% area = 149.0 sq deg
90% area = 616.4 sq deg



Show Weighted Galaxies (or table).

Time and Place

Universal time
2015-09-14T09:50:45
E Longitude Latitude

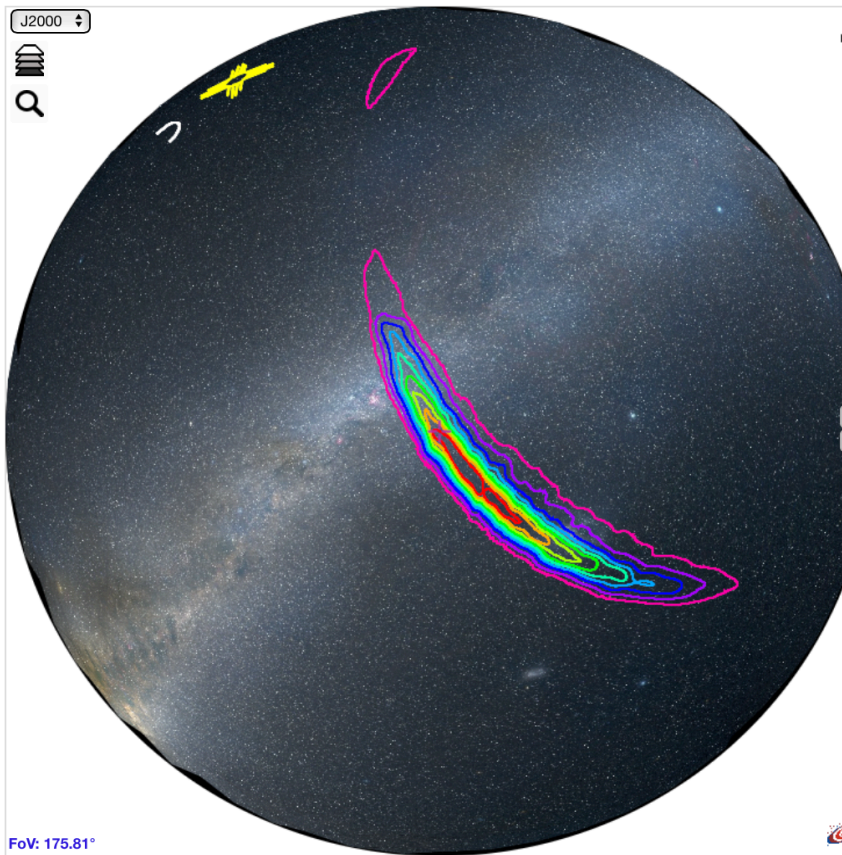
Sun = and = Moon

Catalog Sources

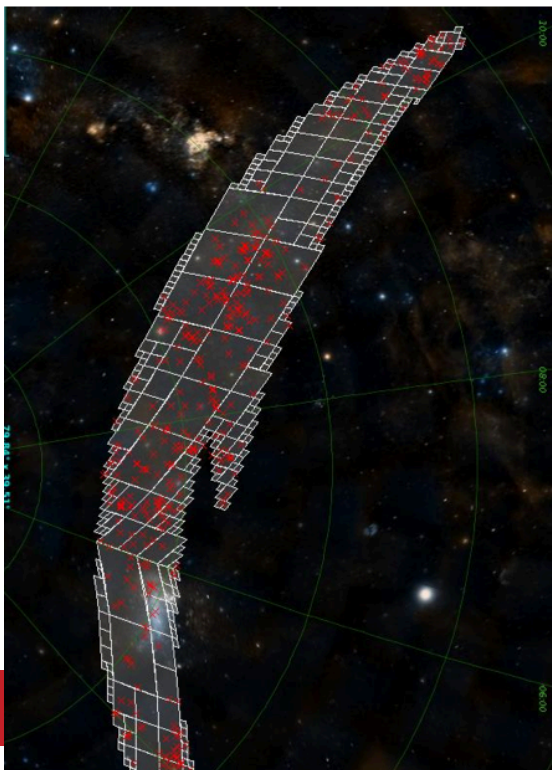
Click the Layers icon to switch on catalogs.
If you click on the sources on the sky, information
will appear here with links to Simbad and NED.

Zoomable Multiwavelength Sky

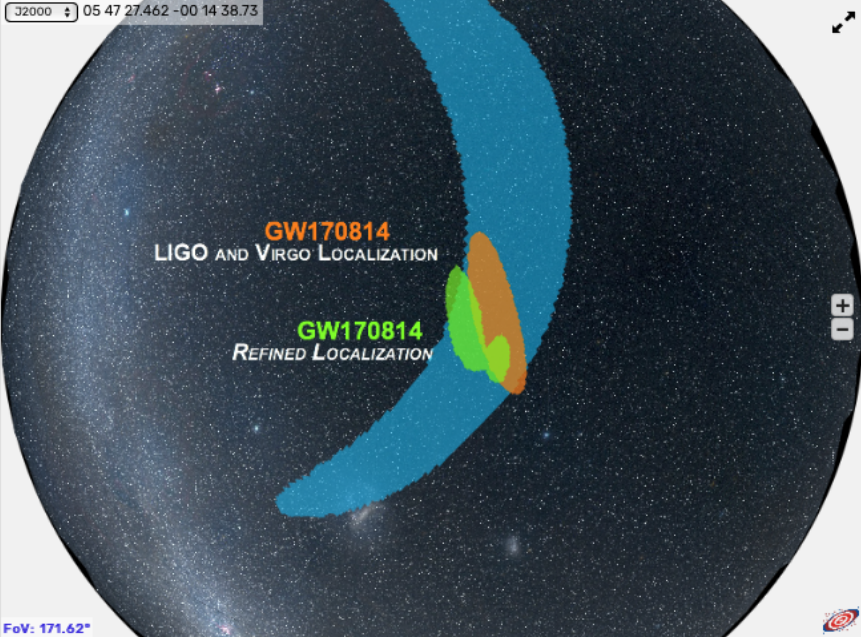
Zoom in on the sky with the mouse or the +/-
icons on the right of the sky. To change the image



FoV: 175.81°



An example of the results



Using the skymap

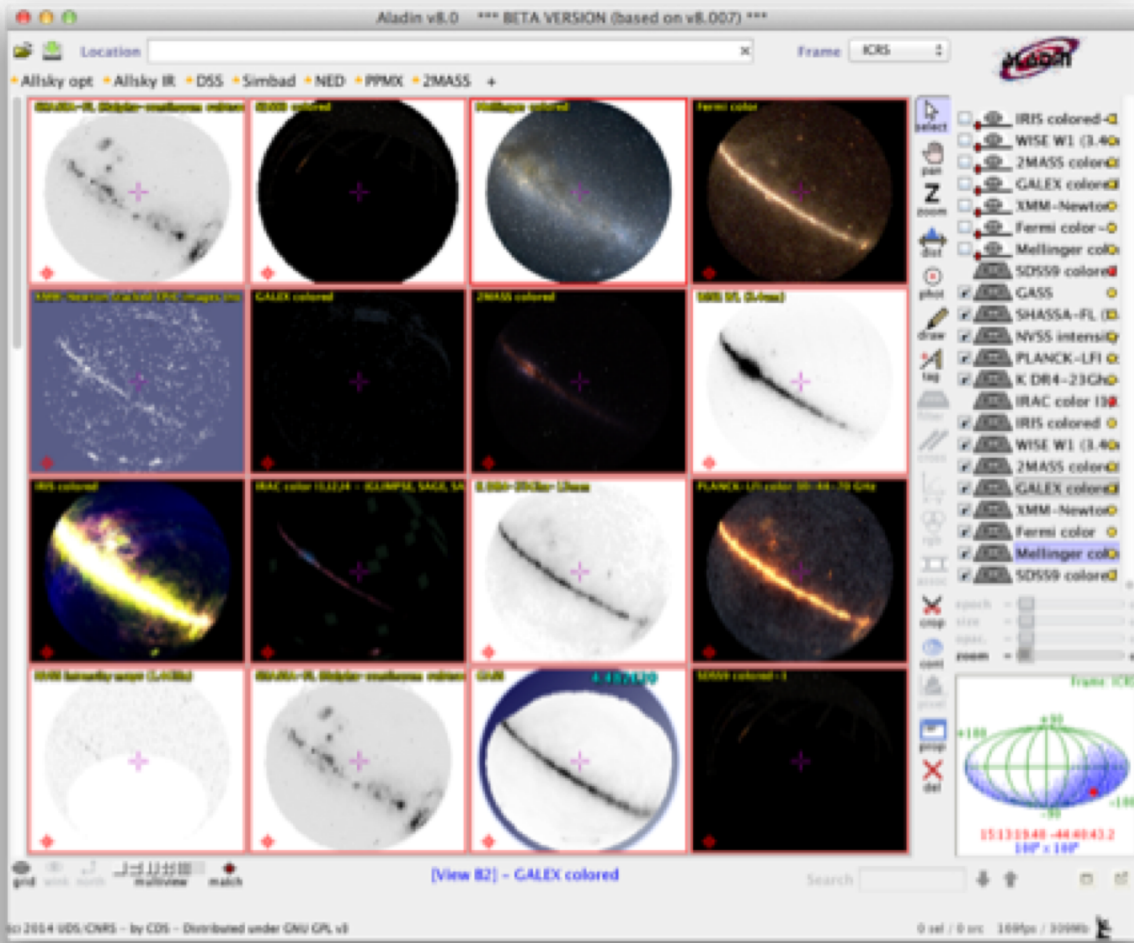
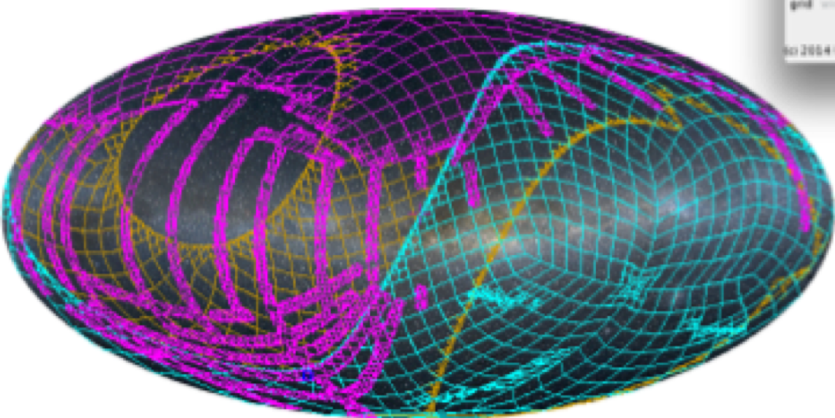
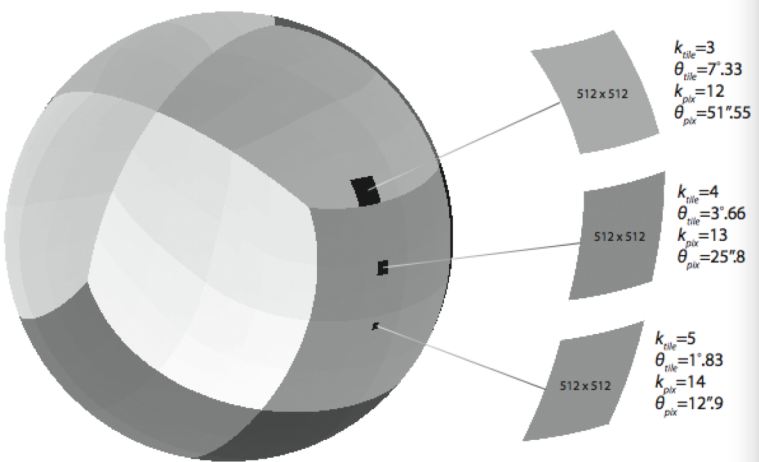
Click on the various options below to display information relating to each detection.

Detection	Sky localisation	Label	Pop-up info
GW170814 - L1/H1 only	✓	<input type="checkbox"/>	<input type="checkbox"/>
GW170814 - L1/H1/V1	✓	<input checked="" type="checkbox"/>	<input type="checkbox"/>
GW170814 - refined skymap	✓	<input checked="" type="checkbox"/>	<input type="checkbox"/>
GW150914	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GW151226	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GW170104	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

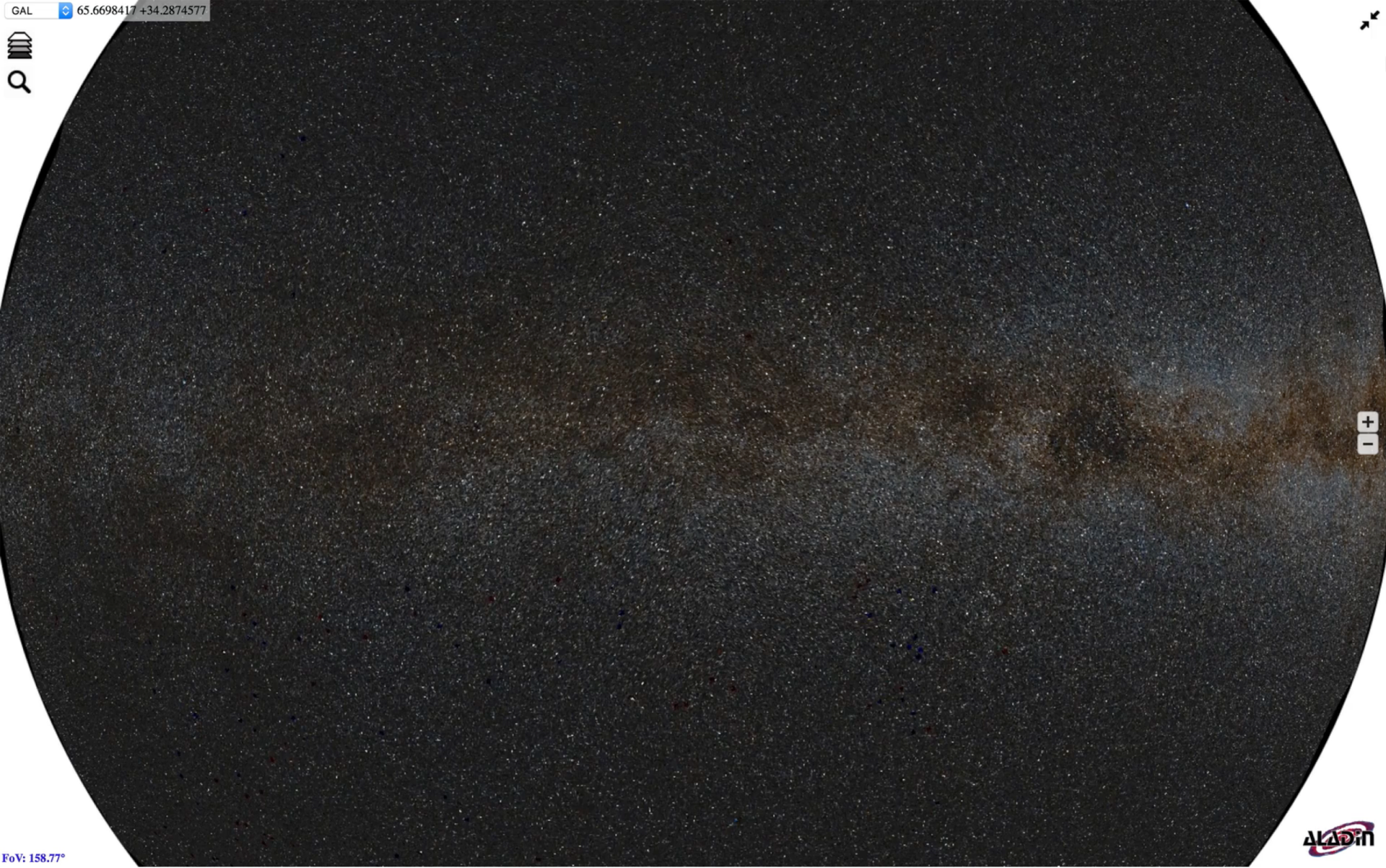
Backgrounds

If you want to see the extension of these sky regions through the constellations you can select an artistic background image **Constellations**.

You can also select various background images at different wavelengths, combining the electromagnetic data with the gravitational-wave information: **Mellinger (default)** WISE 2MASS DSS color XMM Fermi



- *IVOA standardisation*
- *VO infrastructure and Science tools*



FoV: 158.77°



VO School

- Training and support

- VO School Madrid, Dec 2015
 - VO School Strasbourg, Nov 2016
 - VO School Madrid, Nov 2017
- **VO School Strasbourg, Nov 2018**



Outcomes in
Europe and beyond

Summary

- ASTERICS project in final phase
- Part of global VO engagement with big astronomy projects
- Next project – ESCAPE
 - Announced today!
- <https://www.asterics2020.eu>
- <http://www.euro-vo.org>