



REINFORCE
REsearch INfrastructures FOR Citizens in Europe



Horizon 2020
European Union Funding
for Research & Innovation

LabEx UnivEarthS 2020 Thematic School "Opening Science" with REINFORCE

Rémy Le Breton, on behalf of REINFORCE

AstroParticule et Cosmologie

2020/12/16

LabEx **UnivEarthS**



Université
de Paris



- ① REINFORCE: General Presentation
- ② REINFORCE: Science Work Packages
- ③ WP4: Deep Sea Hunters with KM3NeT
- ④ Zooniverse Demonstrators: WP4 example
- ⑤ Conclusions



REINFORCE has started the 2019/12/01

Website: <https://reinforceeu.eu/>

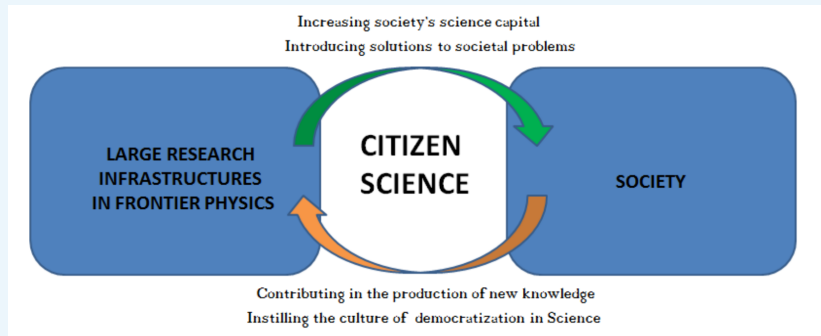
Minimizing the knowledge gap between Large Research Infrastructures and Society through Citizen Science:

- ① Change in awareness and understanding of basic research and its impact on society
- ② Development of new knowledge and innovations by citizen
- ③ Availability of evaluation data concerning societal, democratic and economic costs and benefits of citizen science
- ④ Indicators to measure the impact of citizen science activities

Goal: Involve more than 100,000 Citizen Scientists!

The role of the Citizen Scientists

- At the interface between the research and the society worlds



Pratically, for some tasks:

- Humans are better than computers!
- We are not enough in the research world!

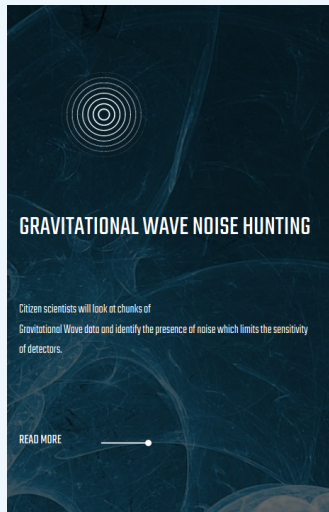
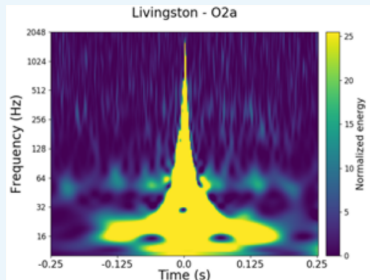
REINFORCE Organization: 11 work packages

- WP1: Management
- WP2: Citizen engagement strategy
- WP3: Gravitational waves
- WP4: Deep Sea Hunters
- WP5: Search for new particles at the LHC
- WP6: Interdisciplinary studies with archeology and geoscience
- WP7: Increasing the senses
- WP8: Participatory engagement activities
- WP9: Impact assessment
- WP10: Raising awareness and sustainability
- WP11: Ethics requirement



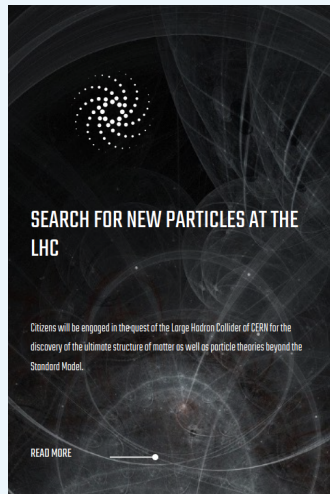
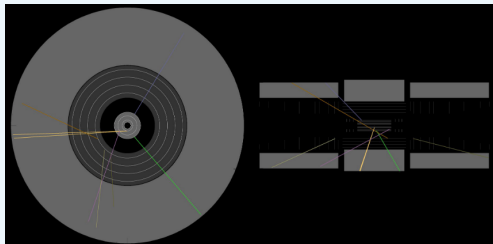
WP3: Gravitational Wave Noise Hunting

- Gravitational Wave antenna data (+ environmental data): VIRGO
- GW signals affected by different noises
- Understand noises to eliminate them
- Citizen scientist: classification of noises
- Machine learning algorithms training
- Also useful for seismic applications



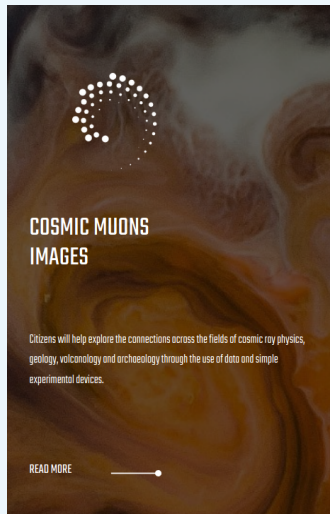
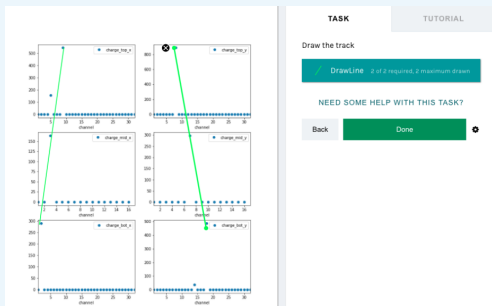
WP5: Search for New Particles at the LHC

- Large Hadron Collider (CERN)
- ATLAS data
- Find new particles
- In certain cases, humans more efficient than computers
- Citizen Scientists: classification, identification of tracks (from e.g. displaced vertices)

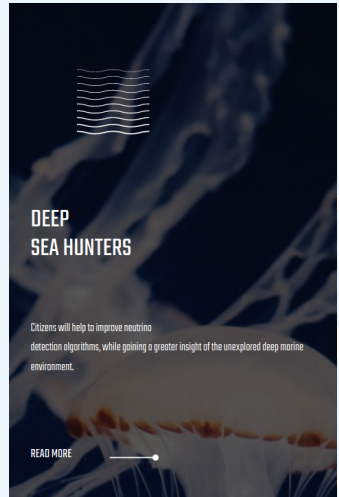


WP6: Cosmic Muons Images

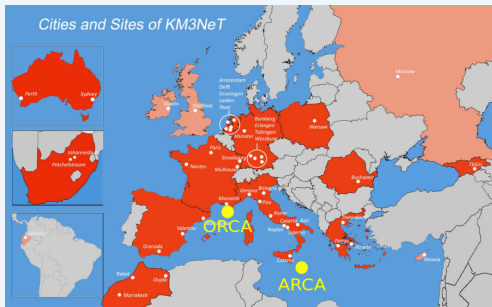
- Muon tomography (non-invasive and non-destructive process)
- Geoscience, Archeology
- Citizen Scientists: monitor volcanos, find hidden chambers in Ancient Structures by identifying tracks in muon detector



- Described in the following slides!



KiloMetre Cube Neutrino Telescope (KM3NeT)

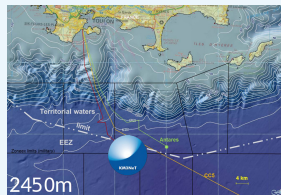


+ Algeria, AstroCeNT, Caen, Georgia and The United Arab Emirates as Observers

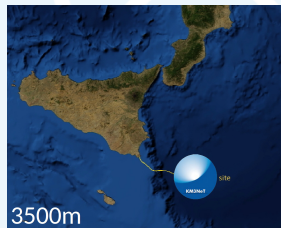
- 57 institutes and groups
- 250+ researchers
- Multi-sites, deep-sea infrastructure
- Selected by ESFRI roadmap

Two detectors ⇔ Same Technology

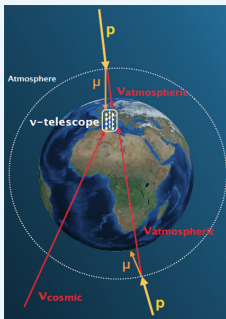
ORCA: Oscillation Research with Cosmics in the Abyss (KM3NeT-Fr)



ARCA: Astroparticle Research with Cosmics in the Abyss (KM3NeT-It)

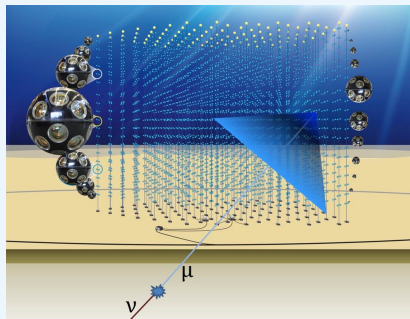


Detection principle



Main sources of events:

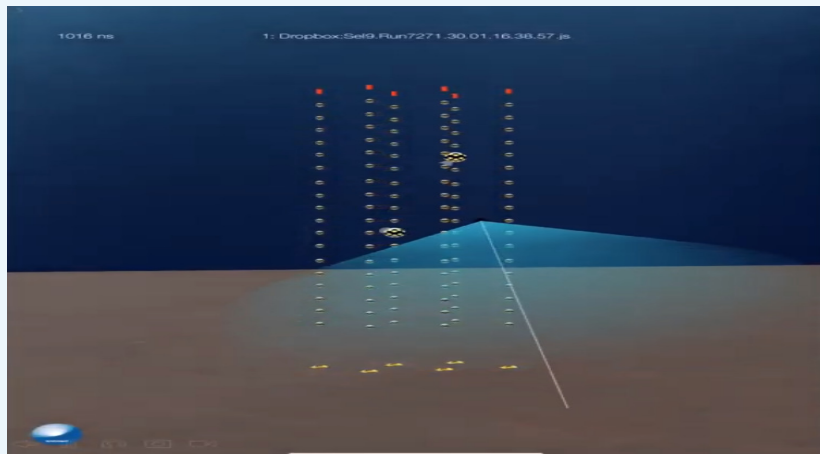
- Cosmic neutrinos
- Atmospheric neutrinos
- Atmospheric muons (down-going)



What is a neutrino telescope?

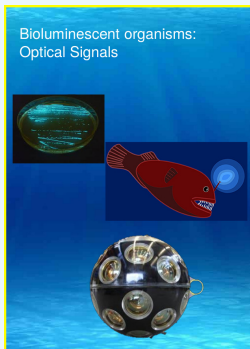
- Detection of the Čerenkov radiation
- 3D array of PMTs
- Deployed in a non-opaque medium
- Energy and direction reconstruction

ORCA: 6 lines deployed and taking data!



Neutrino candidates, ORCA 6 DUs (Video)

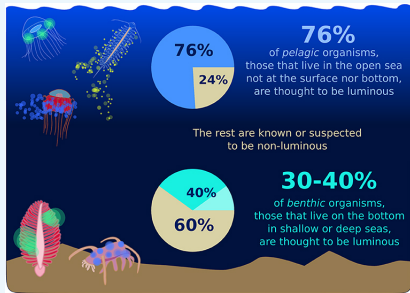
WP4 Deep Sea Hunters: Goals



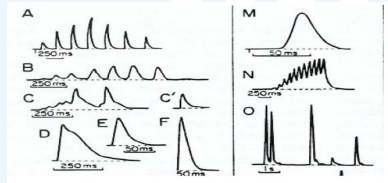
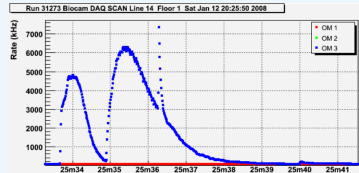
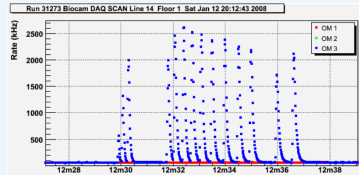
- Classify *bioluminescence* and *bio-acoustic* waveforms in Zooniverse
- Appreciate the biodiversity in the deep sea
- New studies, big potential for interesting discoveries!
- Compare with and improve **machine learning** algorithms
- Help us to understand our optical and acoustic **backgrounds**

Bioluminescence

- Identify **known** and **unknown** bioluminescent species by classifying their characteristic signals

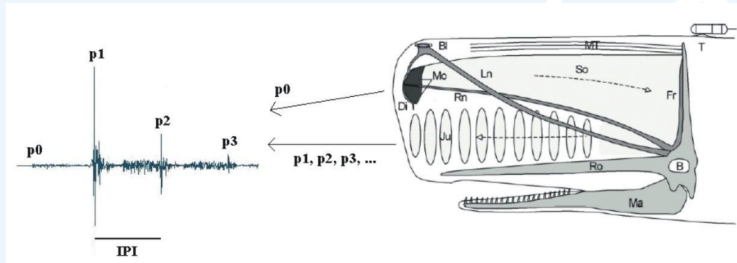
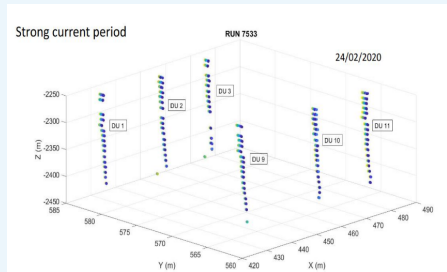


The Dark Ocean Is Full of Lights



Bio-acoustics

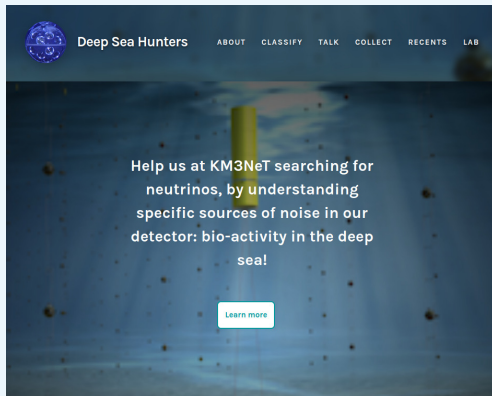
- All cetaceans emit acoustic signals: communication, preys location, to repel predators, etc.
- Give information on: size, sex and age



Live demo

Zooniverse ([website](#))

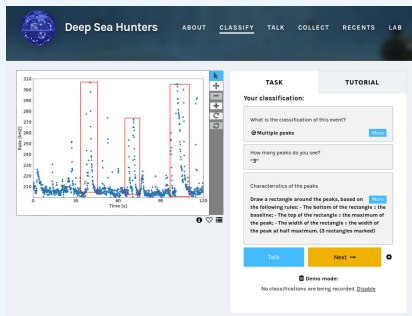
- Front page
- Introduction
- Learn more:
 - Research Tab
 - Team Tab
- Two workflows:
 - Bio-luminescence
 - Bio-acoustics



Bioluminescence and Bio-acoustic classifications

Live demo

- Tutorials
- Different categories
- Different tasks for each categories to test which one is better
- We will add new workflows thanks to the Citizen Scientists' feedbacks



REsearch **IN**frastructure **FOR** Citizen in **EU**rope

- Minimize knowledge gap between large research infrastructures and society
- Involve many Citizen Scientists (100,000+)!
- 4 science work packages
- Zooniverse platform

Thanks for your attention!

