REINFORCE
REsearch INfrastructure FOR Citizen in Europe

R. Le Breton[a], V. Bertin[b], P. Coyle[b], G. de Wasseige[a], H. Glotin[d,e], C. Guidi[b], F. Huang[b], S. Martini[c], A. Kouchner[a,e], C. Tamburini[c], V. van Elewyck[a,e]

On behalf of the REINFORCE Consortium and KM3NeT Collaboration

REINFORCE (in a nutshell)

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!

ZOONIVERSE

ZOONIVERSE: People-powered research https://www.zooniverse.org/

- Citizen Science Activities
- Great visibility

SCAN ME

Each science work package are proposing classification activities on real data from their related experiment in the Zooniverse platform

CITIZEN SCIENCE

Why Citizen Science?

Practically, for some tasks:
- Humans are better than computers!
- We are not enough in the research world!

Increasing society's science capital
Introducing solutions to societal problems

LARGE RESEARCH INFRASTRUCTURES IN FRONTIER PHYSICS — **Citizen Science** — SOCIETY

Contributing in the production of new knowledge
Instilling the culture of democratization in Science

WORK-PACKAGES

1 accessibility Work Package:
- **WP7: sonoUno, Increasing the senses**
  - "sonoUno is a *User Centered* software that allows people with different sensory styles to explore scientific data, visually and by sonorization"
  - http://sion.frm.utn.edu.ar/sonoUno/

4 Science Work Packages:
- **WP3: Gravitational Wave Noise Hunting**
  - Have a better understanding of noises in VIRGO data
- **WP4: Deep Sea Hunters**
  - Perform completely new studies of bioluminescence and bioacoustics at the bottom of the sea and to have a better understanding of noises in KM3NeT data
- **WP5: Search for new particles at the LHC**
  - Find new particles in ATLAS data at LHC/CERN
- **WP6: Cosmic muon Images**
  - Use muon tomography, a non-invasive and non-destructive process, to do geoscience (e.g. to monitor volcanoes) and archeology (e.g. to find hidden chamber in ancient structures!)
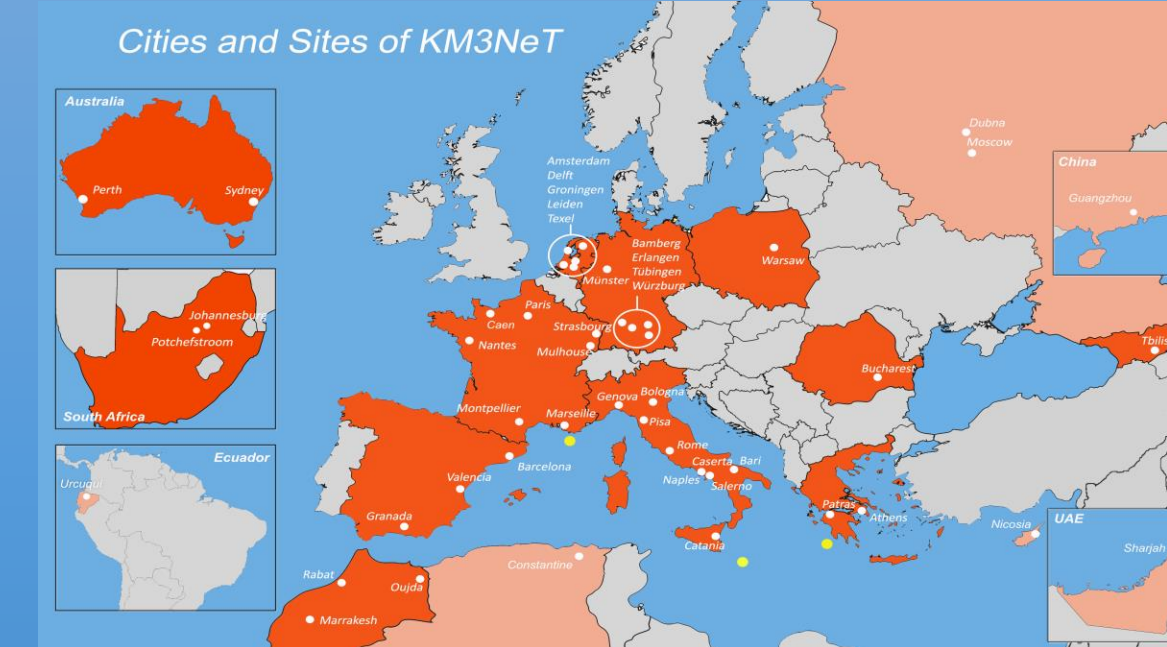
KM3NeT

WP4: Deep Sea Hunters

Context: Kilometer Cube Neutrino Telescope
- KM3NeT is a 3D array of PMTs* at the bottom of the sea, used to capture Cherenkov light.
- Completion foreseen in the Mediterranean Sea in 2025/2026
- ORCA* will study neutrino properties such as the Neutrino Mass Hierarchy (E ~ GeV)
- ARCA* will do neutrino and multi-messenger astronomy (E > TeV)

Cities and Sites of KM3NeT

KM3NeT Collaboration | Illustration of a neutrino event

Citizen Scientists will help us studying bio-activity in the deep sea with KM3NeT data! Thanks to them, we will also better understand what is a source of noise in our detector, making our search for neutrinos easier!
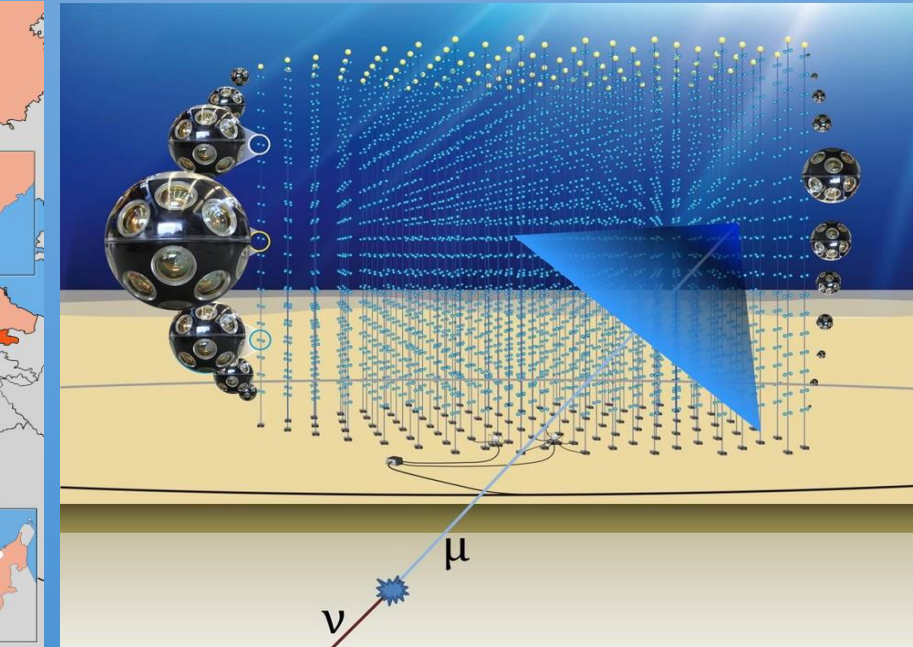
BIOLUMINESCENCE

One of the main optical noise in KM3NeT is bioluminescence, a very common phenomenon in open water (around 70% of the marine species emit light!)

Goals:
- Study bioluminescence in the deep sea, which is a completely new study!
- Very large volume of study (KM³!)
- Have a better understanding of the main optical noise in KM3NeT
- Identify new species
- Have a better understanding of some bioluminescent phenomena
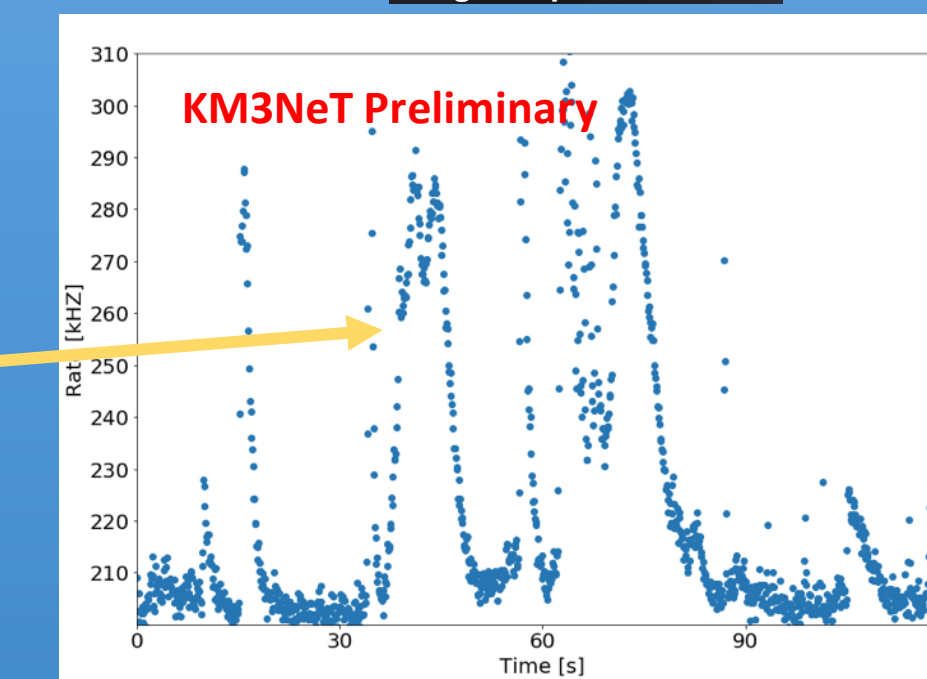- Develop machine learning identification algorithm

Proposed activity:
- Classification of peaks (light) in different categories, to be refined with other rounds of classification!

To know more about bioluminescence:
https://kids.frontiersin.org/article/10.3389/frym.2020.00069

Digital Optical Module

KM3NeT Preliminary

BIOACOUSTICS

We can use KM3NeT hydrophones, parts of the positioning calibration system, to detect cetaceans!

Goals:
- Increase sensitivity of machine learning identification algorithms
- Have a better understanding of what can be noises in KM3NeT hydrophones
- Track and count cetaceans in the Mediterranean Sea, as function of the species and period of the year
- Develop real-time anti-collision system to avoid accidents between boats and animals
- Have a better understanding of cetaceans lives (hunting, migration)

Proposed activity:
- Classification of cetacean clicks*

KM3NeT Preliminary
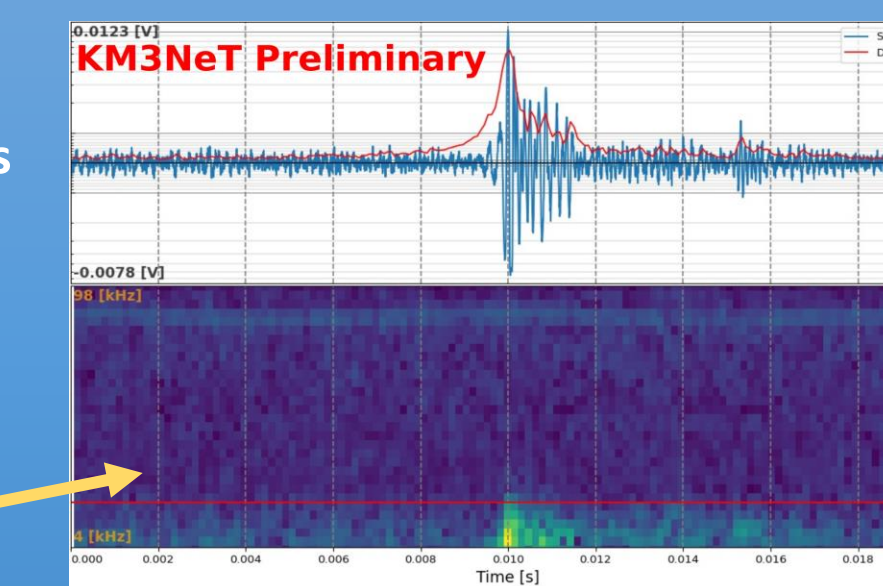
Sperm Whale click as seen with KM3NeT's hydrophones

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*ORCA: Oscillation Research with Cosmics in the Abyss ; *Click: short sound wave
*ARCA: Astronomy Research with Cosmics in the Abyss ; *PMT: Photomultiplier Tube

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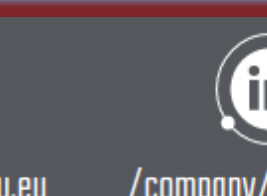
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