



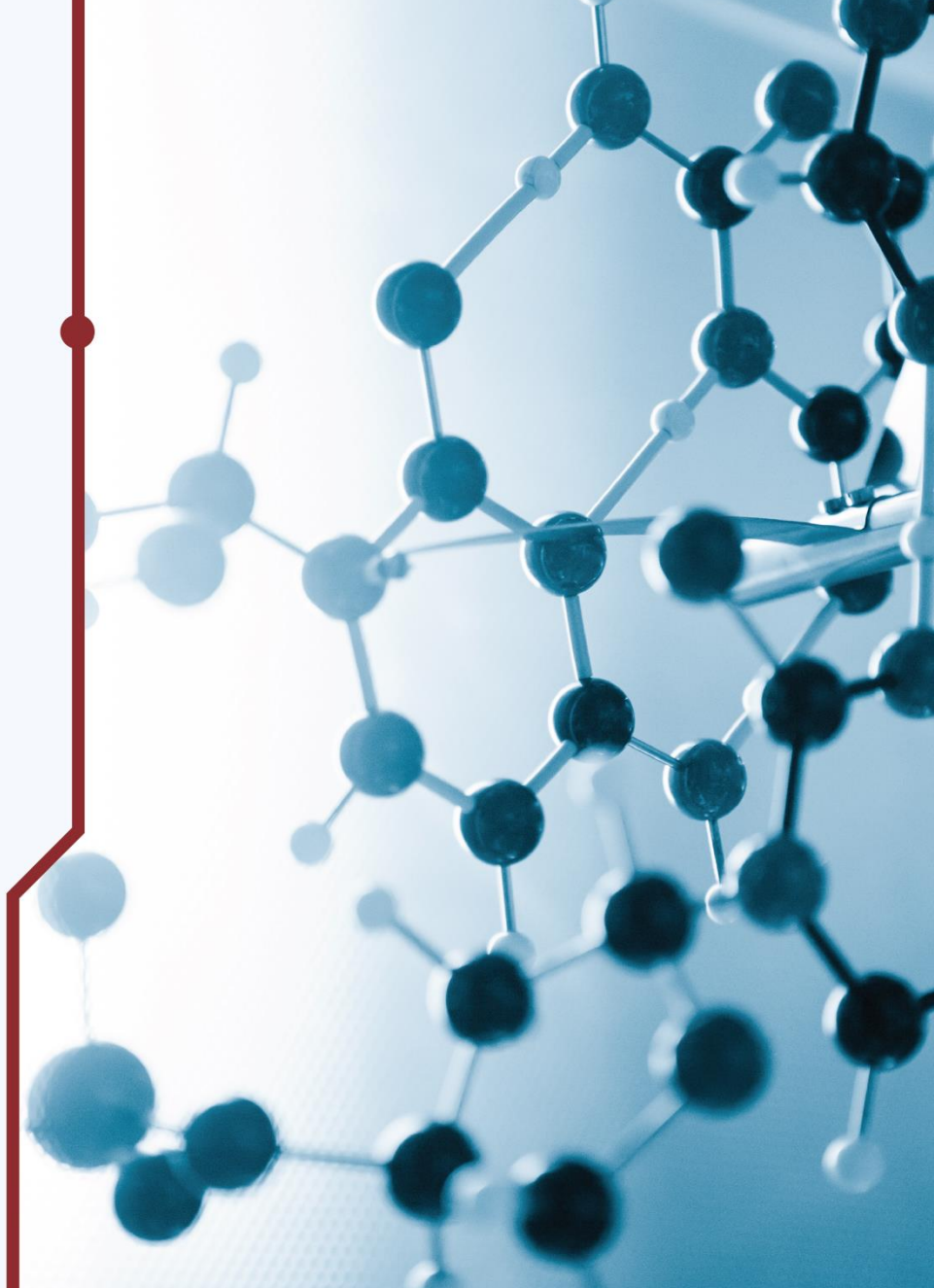
REINFORCE

REsearch INfrastructures FOR Citizens in Europe

Citizen Science In My School

Vision-Building Workshop
22 June 2020

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Research and Development Department,
Ellinogermaniki Agogi





Session 1:

Citizen science and education (45 mins)

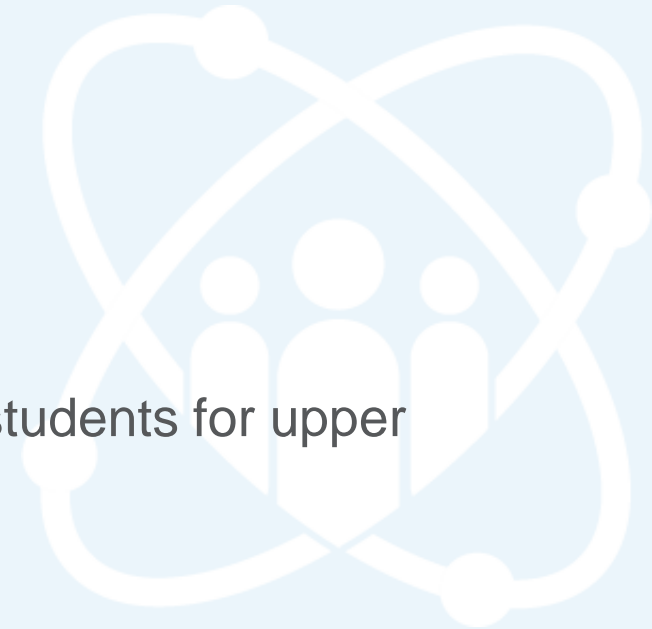
- Discuss with you 'Citizen Science' in Education
- Challenges of Citizen Science in Schools for teachers & students
- Challenges of Citizen Science in Schools for the scientists
- Benefits of Citizen Science in School Education

-5 mins break-

Session 2:

An educational scenario to introduce glitch hunting in the classroom (1 hr)

- Quick overview (10 mins)
- Gravitational Wave Noise Hunting – project like activity to do with your students for upper secondary. (30 mins)
- Hunting for glitches (20 mins)



What is citizen science?



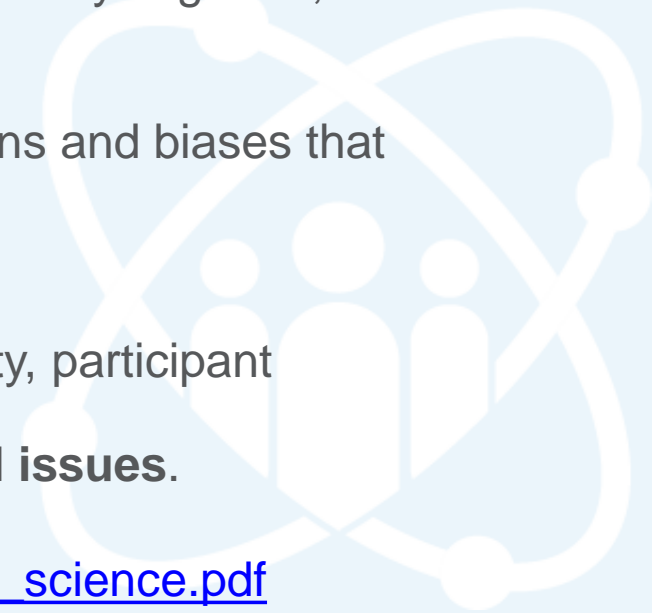
<https://www.youtube.com/watch?v=N6eN3PII4U8>
<https://www.youtube.com/watch?v=fQqkbH4h6YM>





10 Principles of Citizen Science (ECSA)

- ❏ CS projects **actively involve citizens in scientific endeavor that generates new knowledge or understanding**. Citizens may act as **contributors, collaborators**, or as project leader and have a **meaningful role** in the project.
- ❏ Citizen science projects have a **genuine science outcome**.
- ❏ Both the professional scientists and the citizen scientists **benefit** from taking part.
- ❏ Citizen scientists may, if they wish, **participate in multiple stages** of the scientific process. This may include developing the research question, designing the method, gathering and analysing data, and communicating the results.
- ❏ Citizen scientists **receive feedback** from the project.
- ❏ Citizen science is considered a **research approach** like any other, with limitations and biases that should be considered.
- ❏ Citizen science project data and meta-data are made **publicly available**.
- ❏ Citizen scientists **are acknowledged** in project results and publications.
- ❏ Citizen science programmes **are evaluated** for their scientific output, data quality, participant experience and wider societal or policy impact.
- ❏ The leaders of citizen science projects take into consideration **legal and ethical issues**.
- ❏ https://ecsa.citizen-science.net/sites/default/files/ecsa_ten_principles_of_citizen_science.pdf



 **Can (or should?) Citizen Science be integrated with formal school education? And how?**

<https://www.menti.com/azwpi4mmof>

www.menti.com – 21 24 68

4 Slides:

- **Benefits**
- **Students' roles**
- **Main challenges**
- **Learning outcomes**





Students as citizen scientists



<https://www.youtube.com/watch?v=Z-YbvtQTY4k>



 “**Young people** spend a large part of their lives in school. Some engage easily, whereas others **struggle to see the ‘relevance’ of what they are studying**. This can be especially true in the sciences, where **concepts often feel remote from a young person’s life**. This is not helped by the fact that experiments they do in class and the data they collect are later thrown away. **What if the data they collect could be preserved because it contributes to scientific knowledge**, and maybe even helps to solve real problems?”*

 **“Promise of citizen science for schools is a win-win: Teachers and students get authentic access to science** in action, including scientists, scientific research questions, processes, data and data analysis, all of which promotes engagement with science and learning opportunities. Meanwhile, **scientists get many enthusiastic volunteers** (students) along with team leaders and data quality filters (teachers), while also expanding public awareness of their research topics and findings.” *

**J.Harlin et. al: “Turning students into citizen scientists”,
in Hecker,S., Haklay, M., Bowser, A., Makuch, Z., Vogel, J., & Bonn, A. 2018 Citizen Science:
Innovation in Open Science, Society and Policy, UCL Press, London. <https://doi.org/10.14324/111/9781787352339>*

Citizen Science In My School

- 🧪 Biology / Environmental Citizen Science projects are relatively common and “easy” to implement in schools.
 - 🧪 Wildlife Biology - <https://scistarter.org/emammal>
 - 🧪 Health/ Nutrition - <https://scistarter.org/space-scurvy>
 - 🧪 Diversity - <https://scistarter.org/the-great-pumpkin-project>
 - 🧪 Water challenge - <https://scistarter.org/earthecho-water-challenge>
- 🧪 What about FRONTIER Science? How can students benefit from or contribute to Citizen Science working with LRI?



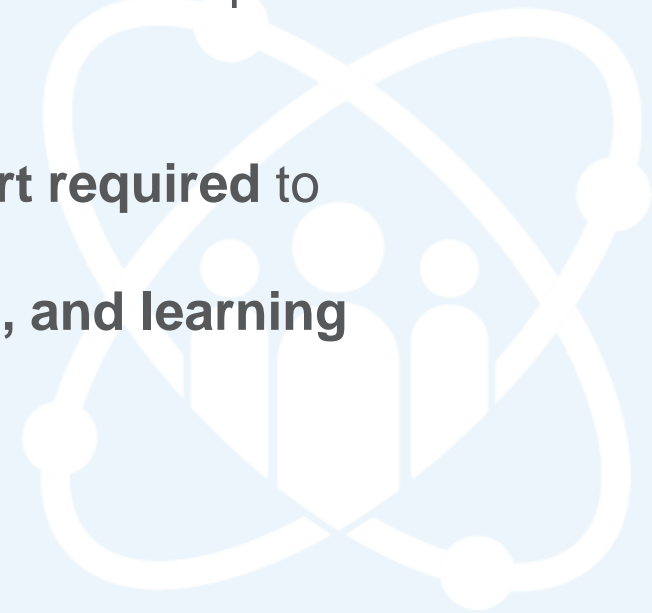
Designing Citizen Science Projects for School

Design Principles

- ✳️ **Curriculum:**
 - **Tie project tasks to the curriculum**, even at the textbook level
 - Offer levels of advancement, both within projects and between projects.
 - **Create adaptable lesson plans** and support teachers creating their own lesson plans

- ✳️ **Resources:**
 - Plan **educational resources** for the teachers to support the **extra effort required** to engage in citizen science
 - Create and moderate a **system for peer-to-peer sharing, discussing, and learning**

- ✳️ **Teacher training and support**
 - Provide hands on **interactive training**
 - Offer **training material**

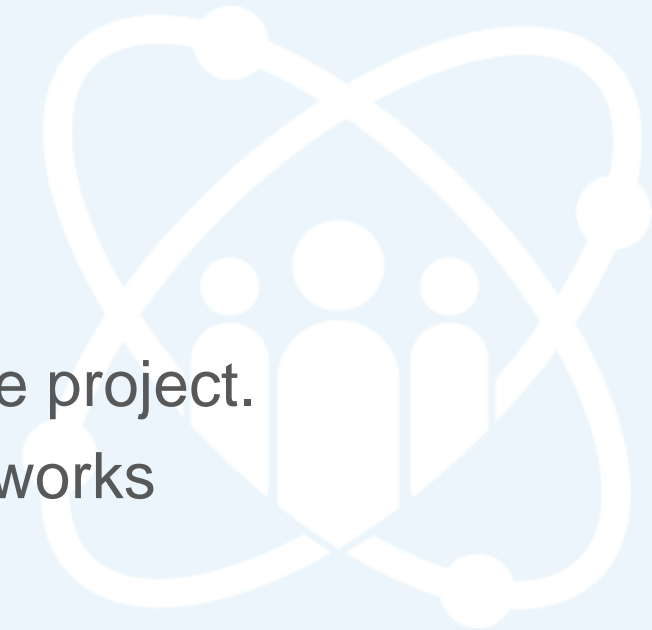


Challenge:

Balancing / Integrating Scientific Goals and Learning outcomes

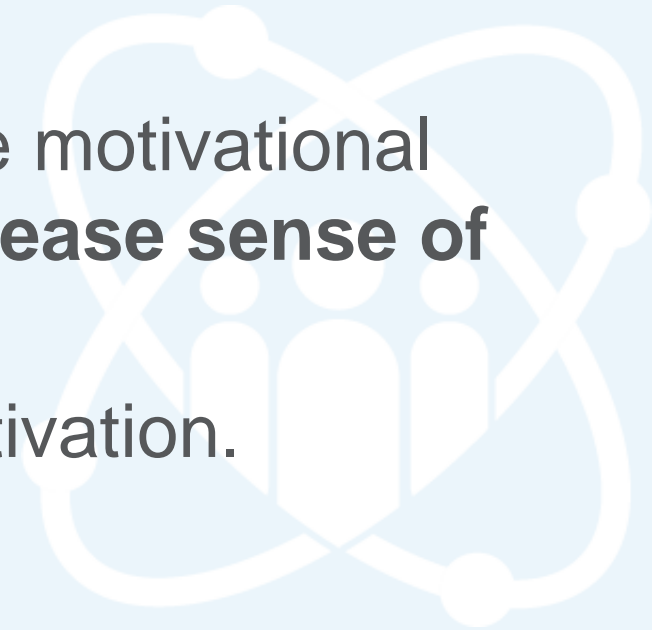
Desired learning outcomes:

- 🧪 Project specific learning
- 🧪 Disciplinary knowledge related to the topic of the project
- 🧪 (Increased) Scientific literacy
- 🧪 Other knowledge and skills unrelated to the main topic of the project.
- 🧪 Personal development – expanding interests and social networks
- 🧪 Identity change



Citizen science projects seem to:

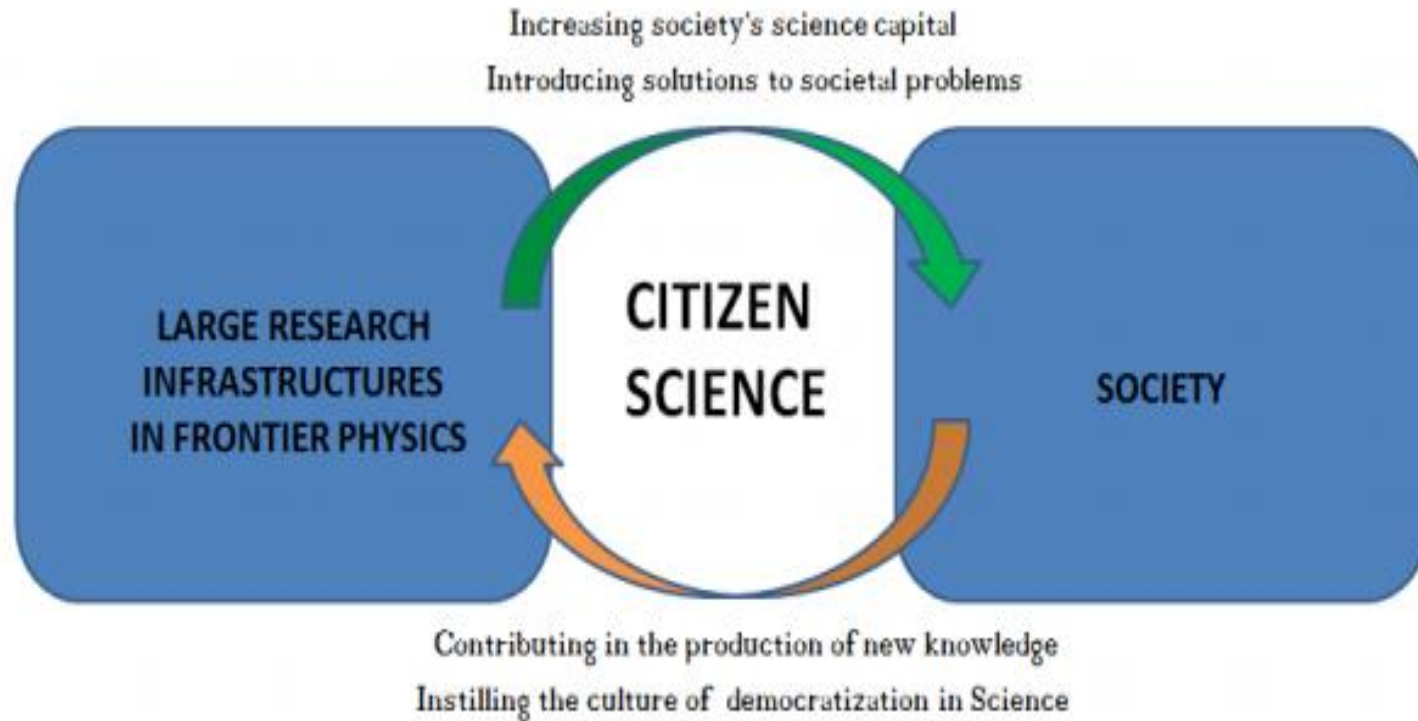
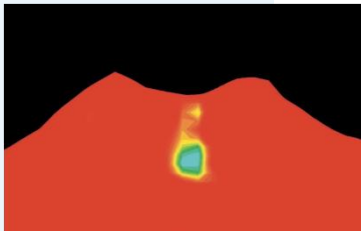
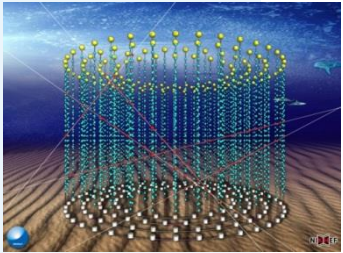
- 🧪 Teach disciplinary knowledge
- 🧪 Increase scientific literacy
- 🧪 Positively alter attitudes towards science
- 🧪 They go beyond science specific outcomes and are motivational and transformative. Participation is reported to **increase sense of meaning of school learning** and science courses.
- 🧪 Feeling of playing a key role increases science motivation.




CITIZEN SCIENCE IN REINFORCE



The interplay of large research infrastructures, citizen science and society in REINFORCE



 **Citizen Science** in REINFORCE is perceived as a **participatory process**, an amalgam of “**contributory**” and “**co-created**” citizen science, in which **citizens** are **trained in frontier science** following a specialized training methodology, they are in **constant connection with researchers** through their communities of practice, they **provide their feedback**, they **voice their concerns** and they **explore the boundaries of knowledge**.



Through REINFORCE, students will be engaged with citizen science projects that go beyond the state of the art in the fields of frontier Physics.

They will be able to substantially **contribute to the development of new knowledge**, and **support the optimization of detectors**

We expect that **REINFORCE will contribute in the reinforcement of the students' science capital.**



THE REINFORCE Citizen Science projects





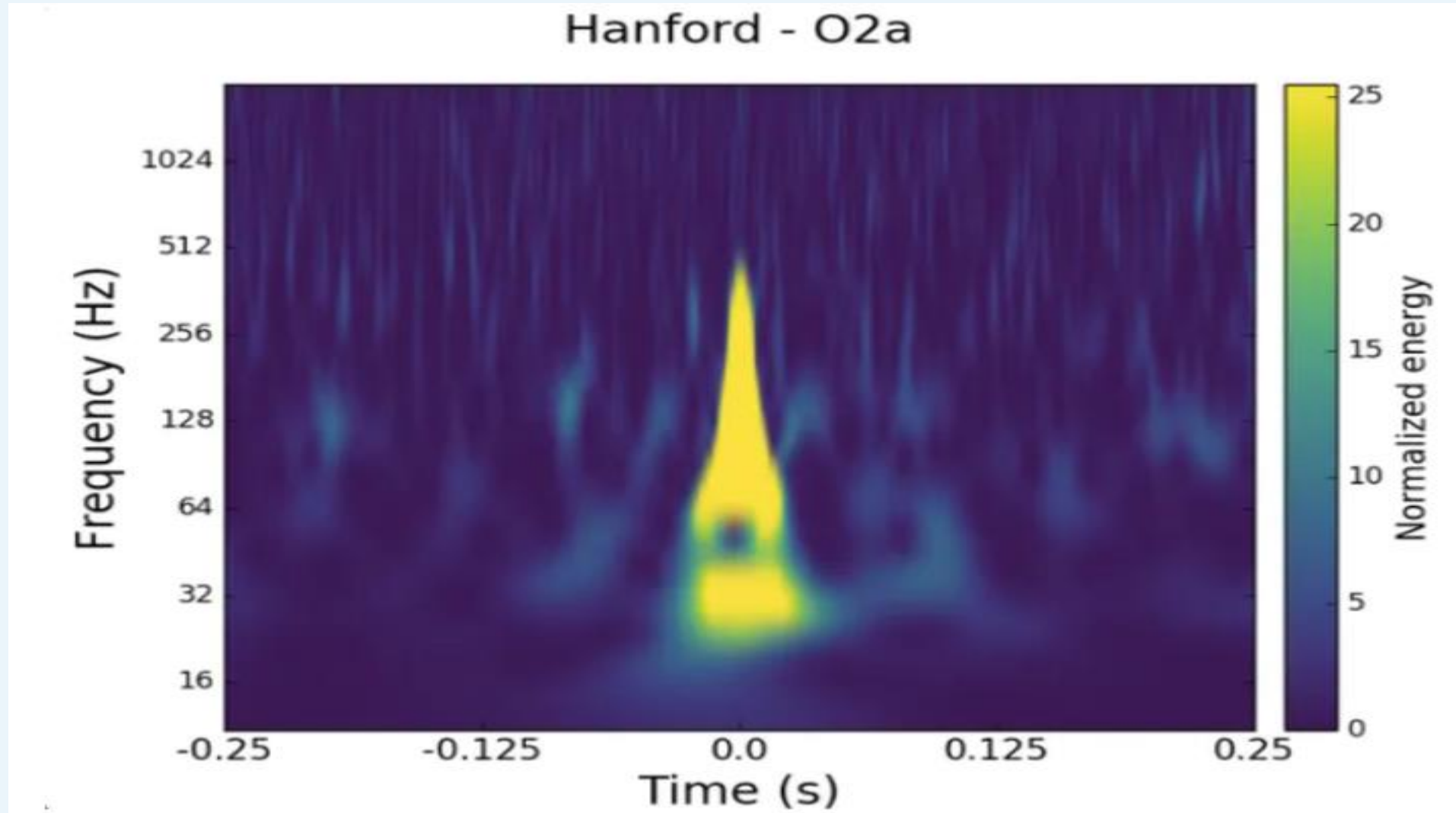
GRAVITATIONAL WAVE NOISE HUNTING

Citizen scientists will look at chunks of
Gravitational Wave data and identify the presence of
noise which limits the sensitivity
of detectors.



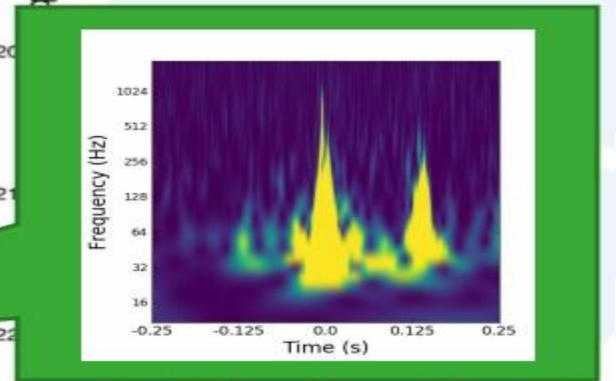
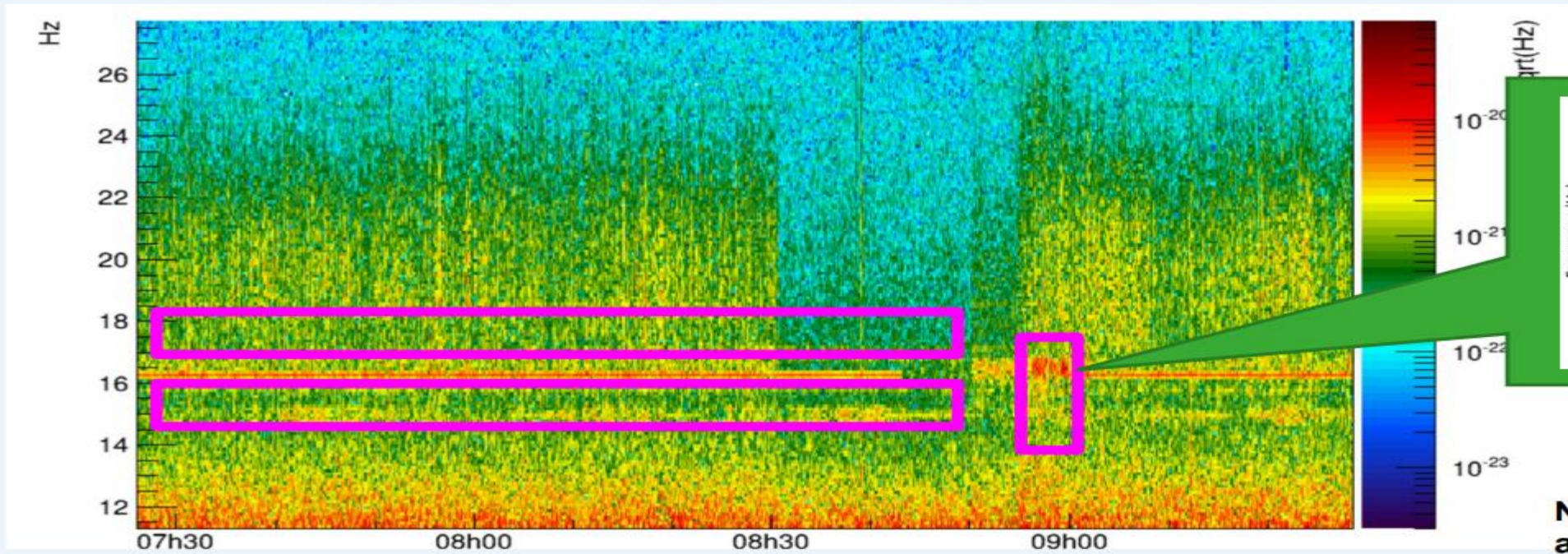


We have already learned about glitch hunting..



We now introduce gravitational wave noise hunting

 You will share findings and find new features



Example of “zoom”
on a glitch

**Not just visual:
also audio representation
will be used**

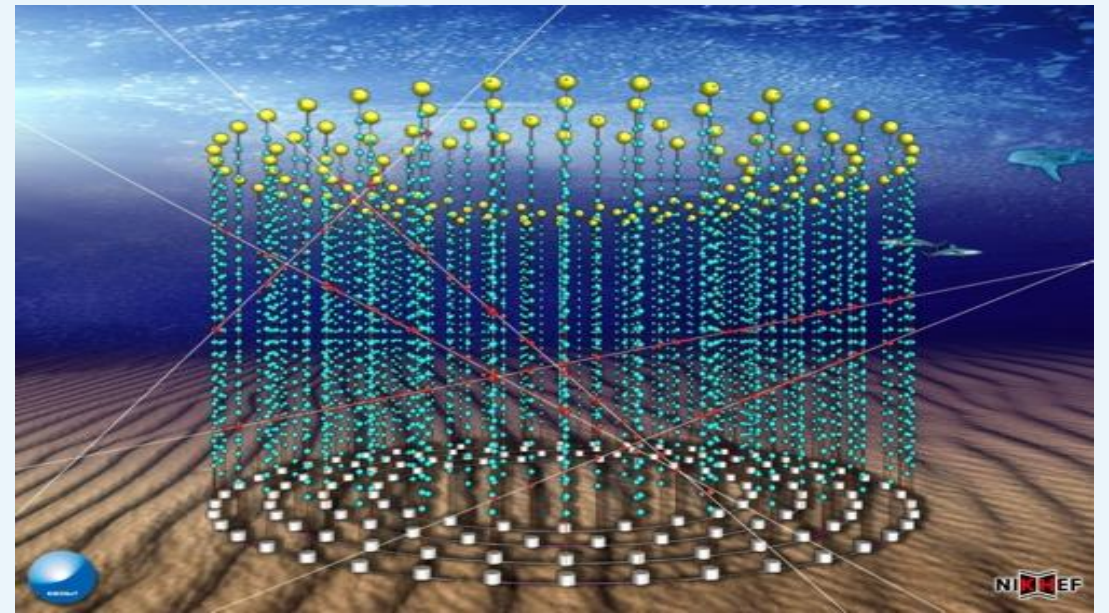
From Virgo logbook

Images adapted from M. Razzano’s (UniPI) presentation:

<https://www.reinforceeu.eu/sites/default/files/2020-06/Gravitational%20Wave%20Noise%20Hunting.pdf>

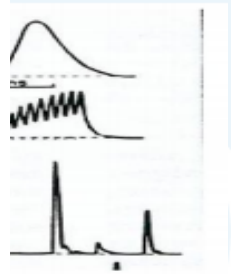
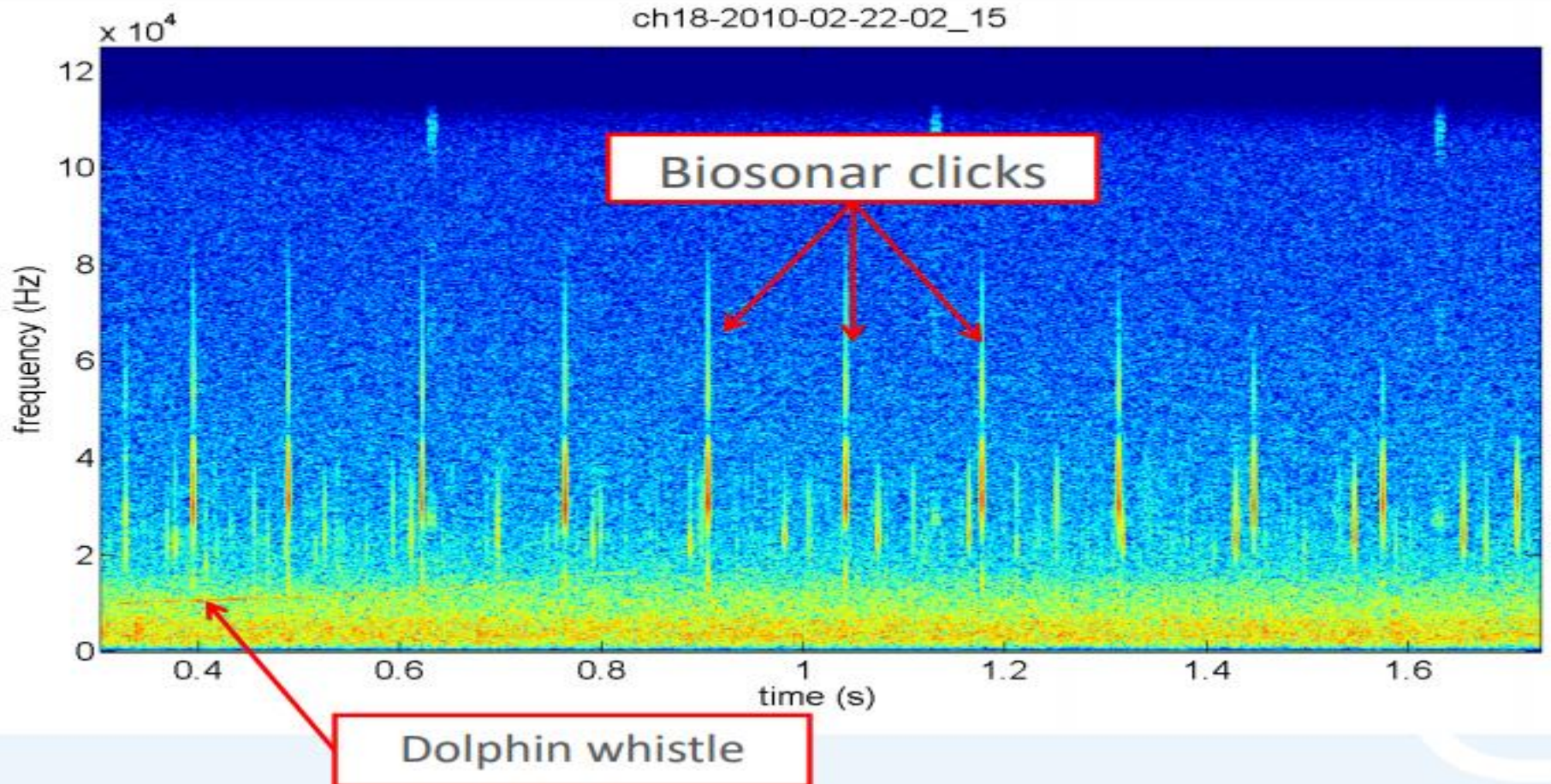
DEEP SEA HUNTERS

Citizens will help to improve neutrino
detection algorithms, while gaining a greater insight of
the unexplored deep marine
environment.





Example Acoustic signals



Then, the squid attacks the prawn and the jellyfish is saved.

Images adapted from Paschal Coyle's (CNRS) presentation:

<https://www.reinforceeu.eu/sites/default/files/2020-06/Deep%20Sea%20Hunters.pdf>



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Citizens will..

- ☒ Help us to understand our optical and acoustic backgrounds
- ☒ Help us to improve our sensitivity to neutrinos
- ☒ Learn about the new field of neutrino astronomy
- ☒ Appreciate the biodiversity in the deep sea even at these enormous depths
- ☒ Such studies have not been done before-really unexplored territory!
→ big potential for interesting discoveries!



SEARCH FOR NEW PARTICLES AT THE LHC

Citizens will be engaged in the quest of the Large Hadron Collider of CERN for the discovery of the ultimate structure of matter as well as particle theories beyond the Standard Model.

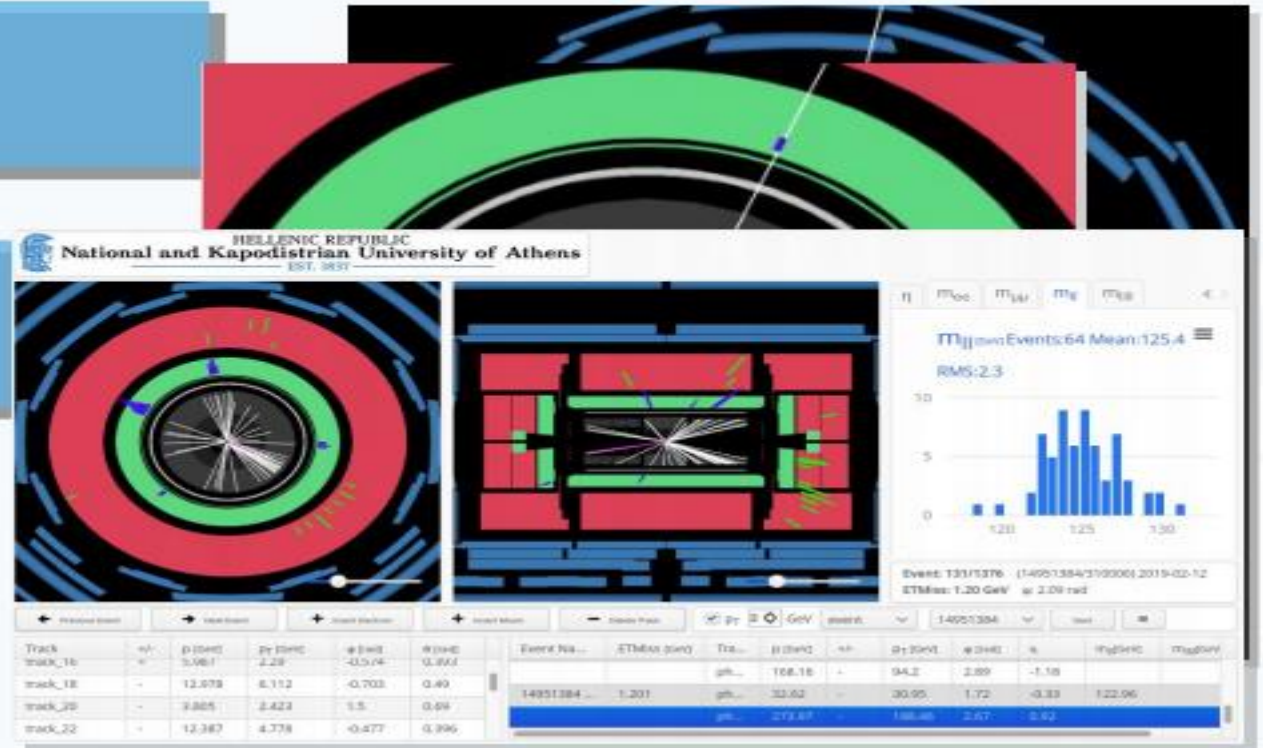


In a nutshell

1. Learn about the different kinds of particles and identify them among collision products.

2. Learn to identify traces of new physics.

3. Scan a large sample of real data to discover new-physics signatures.

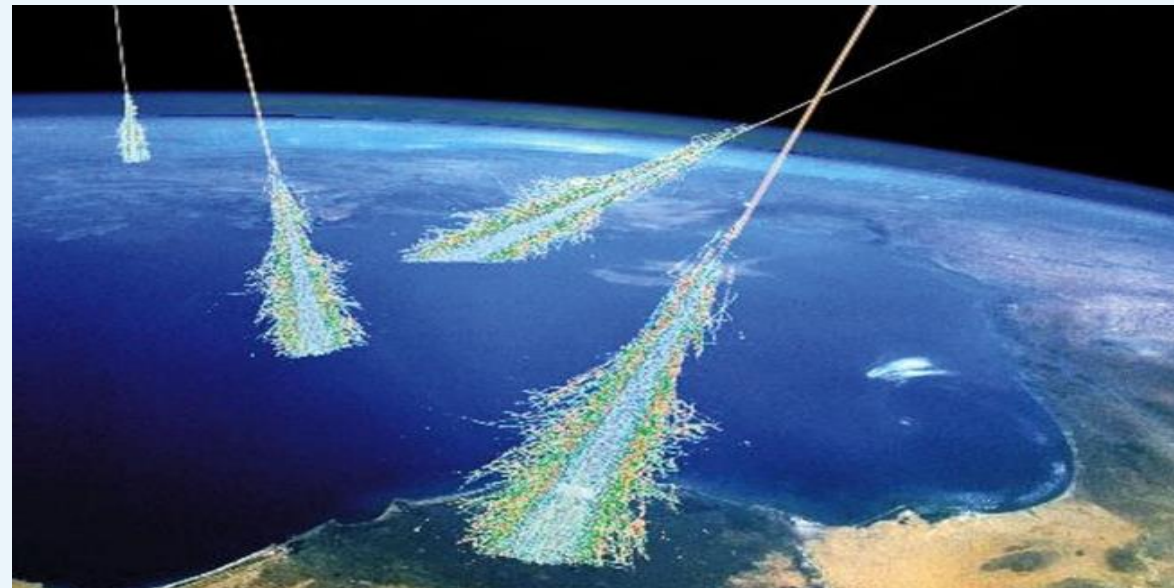


Images adapted from Stylianos Angelidakis's (IASA) presentation:

https://www.reinforce.eu/sites/default/files/2020-06/Search%20for%20New%20Particles%20at%20the%20LHC_0.pdf

COSMIC MUONS IMAGES

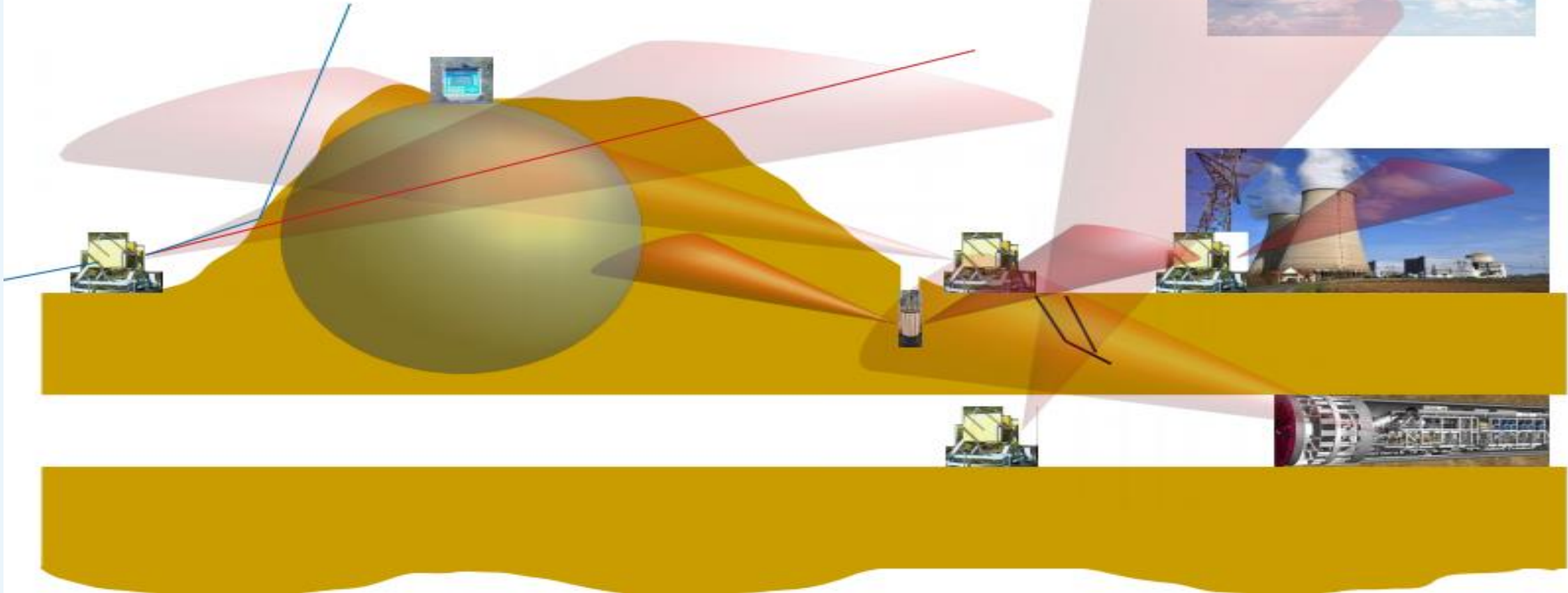
Citizens will help explore the connections across the fields of cosmic ray physics, geology, volcanology and archaeology through the use of data and simple experimental devices.




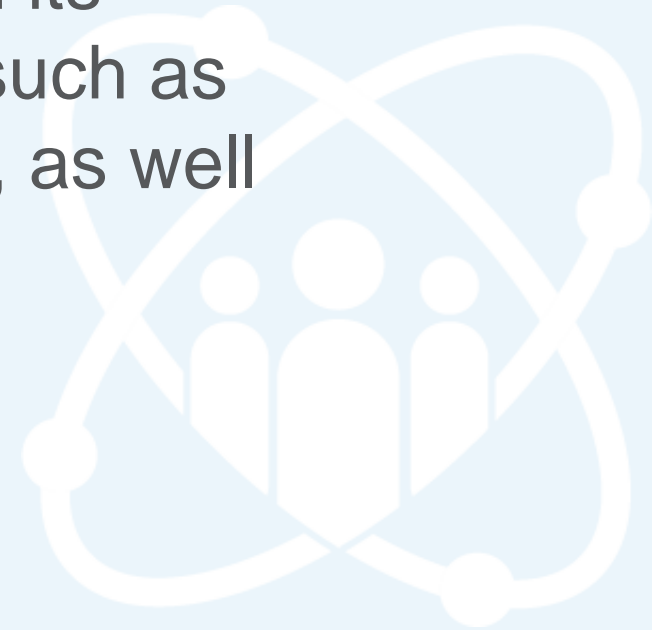


1. "radio"-like structural imaging & monitoring
2. "scanner"-like structural imaging & monitoring
3. joined analysis with geotechnics
4. static underground imaging (+atmosphere physics)
5. dynamic underground imaging
6. borehole applications

Muon Tomography use cases



 In order for citizens to help explore the connections across the fields of cosmic ray physics, geology, volcanology and archaeology, REINFORCE will focus on interdisciplinary efforts for a multi-messenger study of the Earth, and its climate, contributing to the understanding of topics such as climate change, volcano, monitoring and marine life, as well as their societal impact.





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Next steps

- ❏ A series of workshops will be organized within the following year to introduce citizens to the subject topics of REINFORCE and obtain feedback on the design of our citizen science activities.
- ❏ The REINFORCE demonstrators will be finalized and deployed for every citizen to use!
- ❏ A series of participatory engagement activities will be launched in order to support and train citizens across Europe!



STAY TUNED!

In the second part of the presentation we will investigate the introduction of frontier Physics in the classroom through a citizen science approach





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Find out more



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www.reinforceeu.eu



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