



FRONTIERS

BRINGING NOBEL PRIZE PHYSICS TO THE CLASSROOM

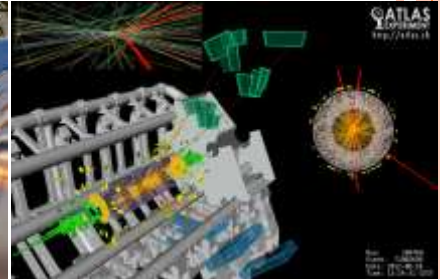
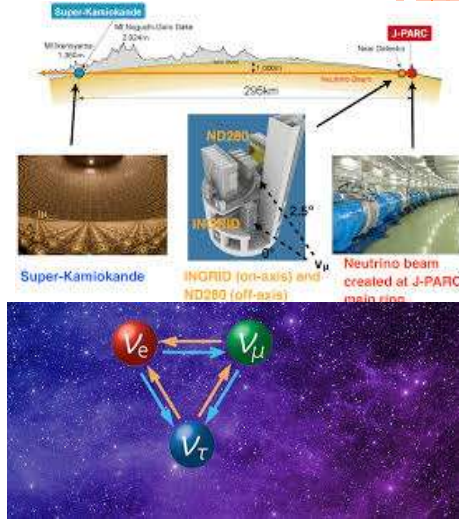
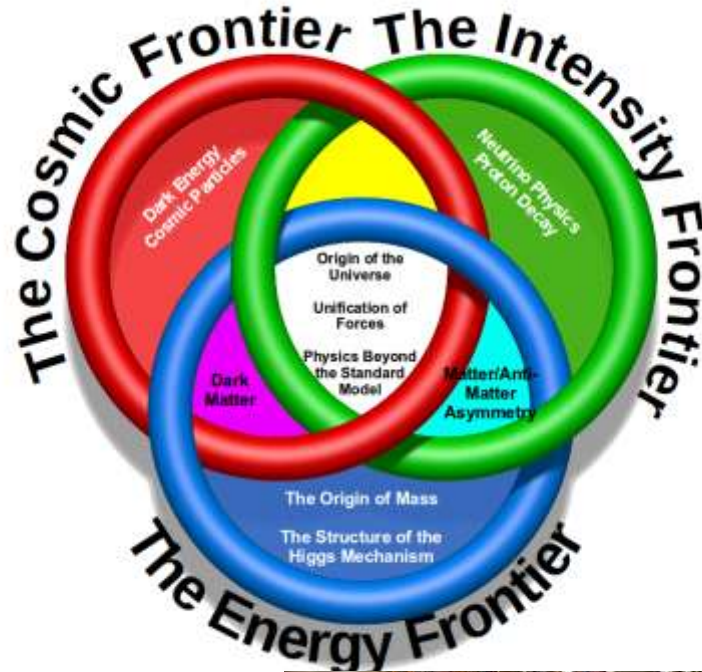
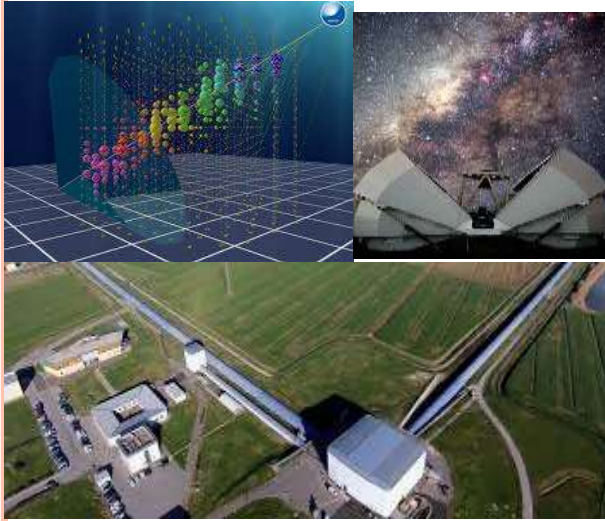
Emmanuel Chaniotakis,
Research and Development Department,
Ellinogermaniki Agogi,
Greece

FRONTIERS e-Summer School: 13-20 /7/ 2020

www.frontiers-project.eu



FRONTIERS IN FUNDAMENTAL SCIENCE RESEARCH



Frontiers has been funded within the framework of the European Union Erasmus+ programme

GAME CHANGING SCIENTIFIC DISCOVERIES WITH GREAT MEDIA COVERAGE

Physics 2013

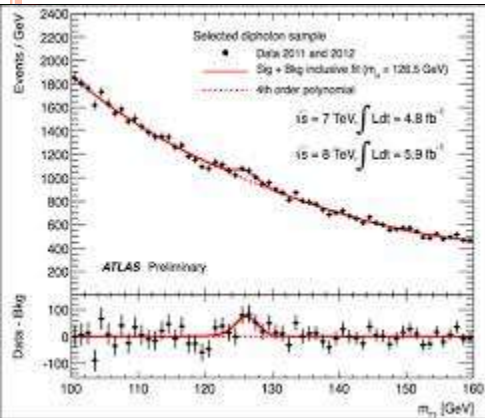
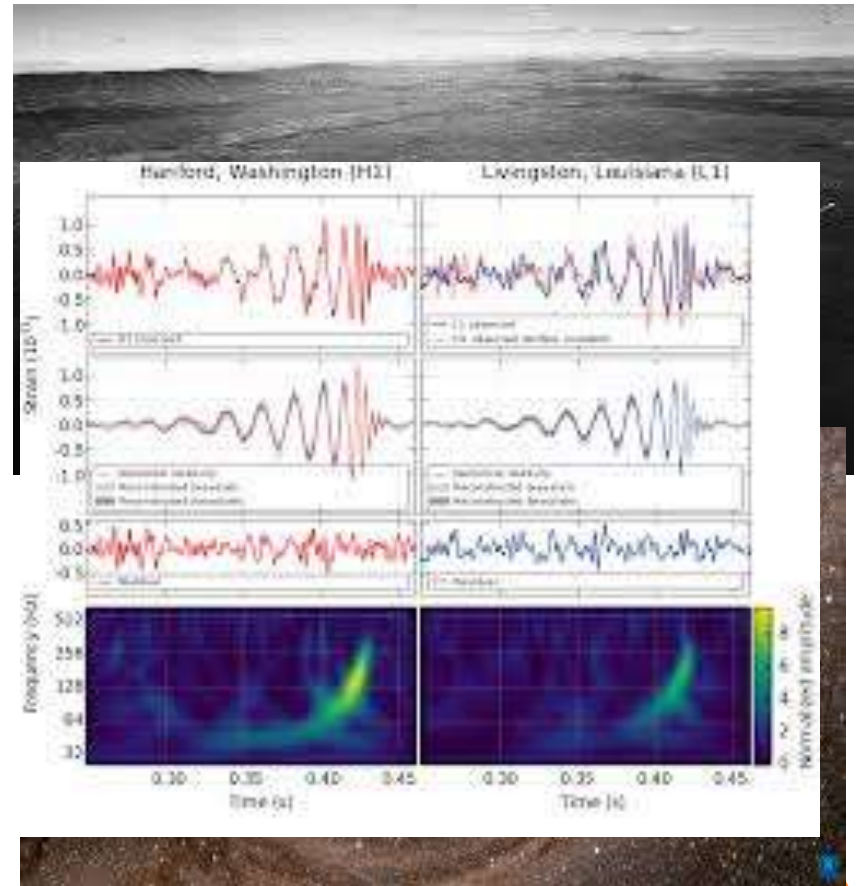
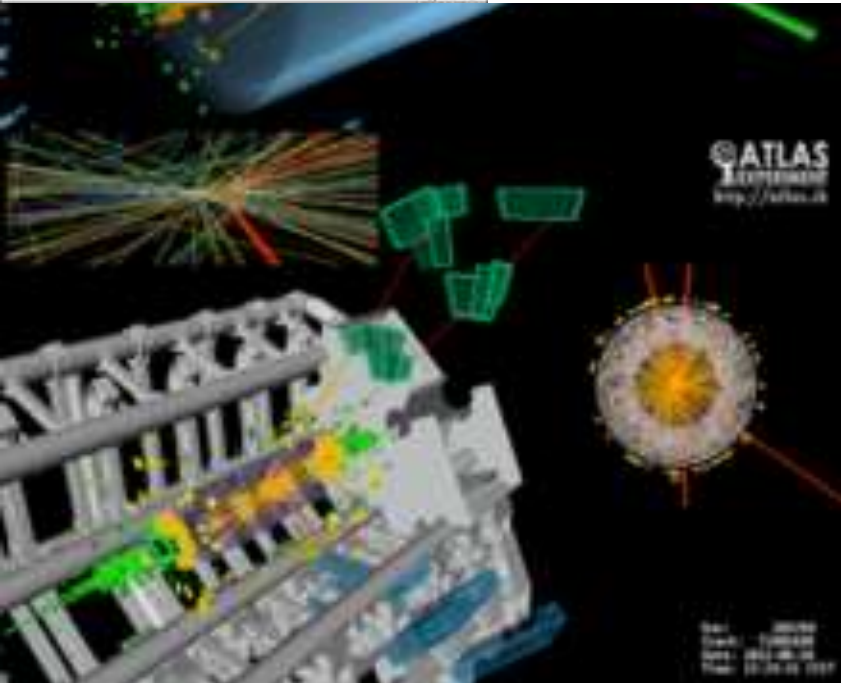


Photo: Pricolet via Wikimedia Commons
François Englert



Photo: G-M Greuel via Wikimedia Commons
Peter W. Higgs



... funded within the framework of the European Union Erasmus+

AND UNPRECEDENTED IMPACT IN HUMANKIND



ld Wide Web

The

A

My goal is simple. It is a complete understanding of the universe, why it is as it is and why it exists at all.

therapy



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YET.. IF YOU SEARCH CERN ON YOUTUBE

The image shows a screenshot of a YouTube search for 'cern'. The search results display a video titled "I'm a Physicist At CERN We've Done Something We Shouldn't Have Done part one" with 6,417,821 views. The video player shows a close-up of the LHC tunnel with a golden figure in the center. A subtitle reads "suspicions they always liked doing these". To the right, there is a card for an article titled "to shine brighter light on CERN" with a "5 MIN READ" indicator. The video player controls show a progress bar at 8:08 / 18:10. The video title and view count are circled in red.



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OR ..FLAT EARTH



flat earth



RALEIGH

People From Around The Globe Met For The First Flat Earth Conference (HBO)

1.420.281 προβολές

13 XIA 5,2 XIA ΚΟΙΝΟΠΟΙΗΣΗ ΑΠΟΘΗΚΕΥΣΗ



VICE News
Δημοσιεύτηκε στις 28 Νοε 2017

ΕΓΓΡΑΦΗ 3,4 ΕΚ

Conspiracy theories are nothing new, but in the age of the internet, they spread like "chemtrails" in the wind. The theory that the world is flat, for example, gained so much popularity online that this year 500 people gathered for the first ever International Flat Earth Conference.



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IT ALL STARTS FROM EDUCATION..

20th Century Physics not
systematically integrated in K12
formal education!



sic

theory & general relativity

Teachers don't feel confident to address students'
questions regarding newest discoveries in modern
science



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MANY EDUCATION AND OUTREACH INITIATIVES, ESPECIALLY IN HEP AND ASTRONOMY



WITH D



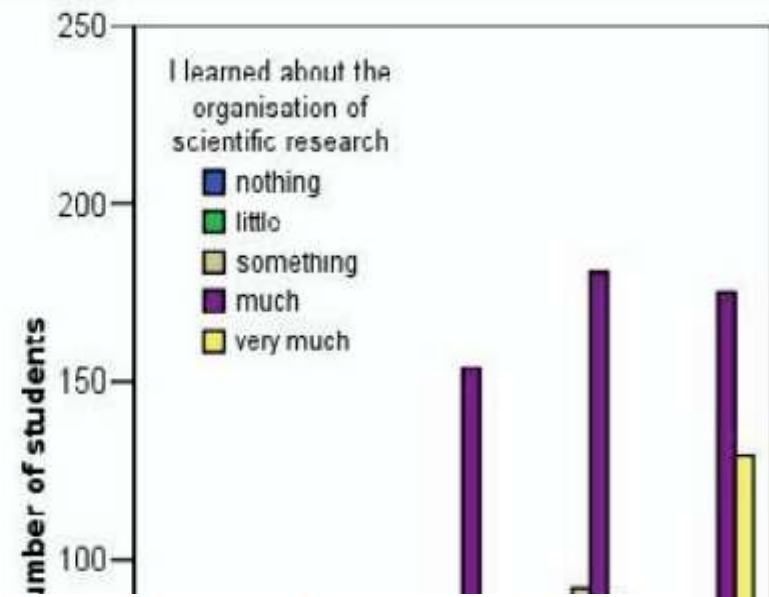
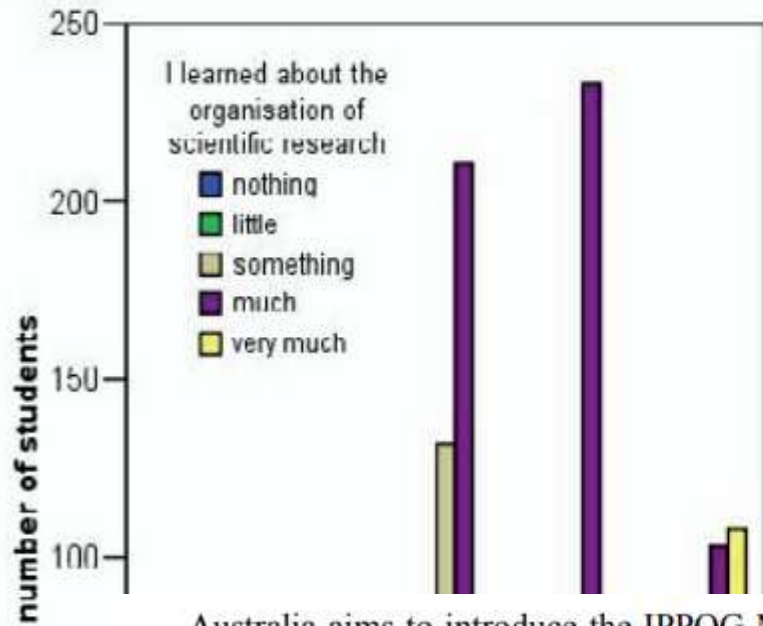
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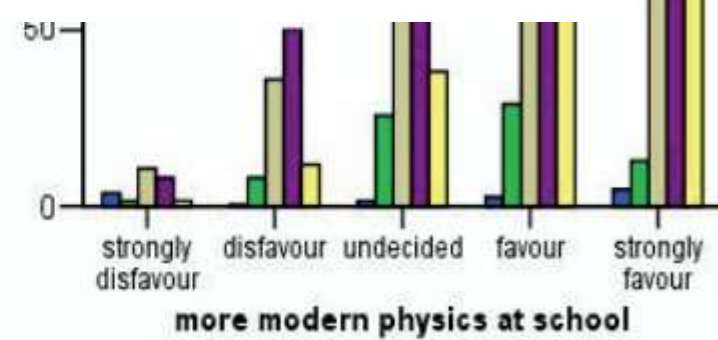
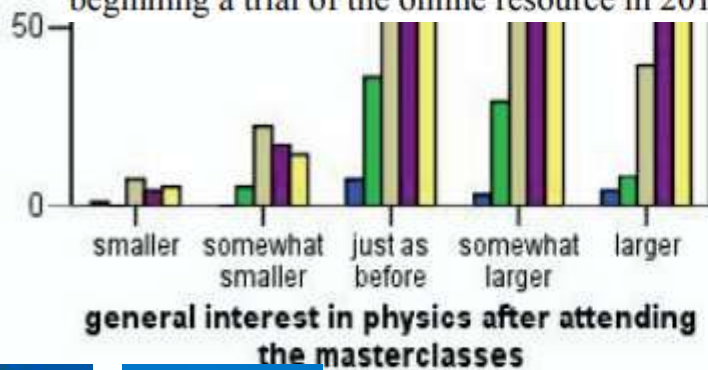
1

-Eras

Union Erasmus+



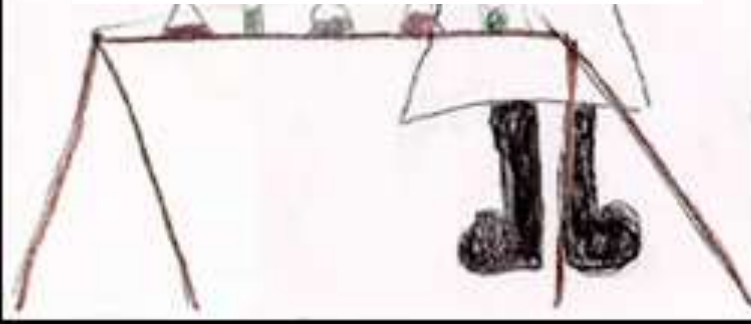
Australia aims to introduce the IPPOG Masterclasses programme as part of their formal science education in high-schools in New South Wales. The NSW Dept. of Education is beginning a trial of the online resource in 2017.



BEFORE



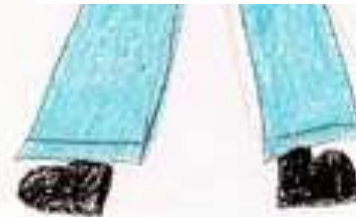
You can see them as a mad scientist with hair standing straight up and a mean wicked laugh. . . . I see them with rubber gloves and safety goggles on. I see them in a chemistry lab surrounded by beakers, graduated cylinders and tables filled with experimental materials.



AFTER

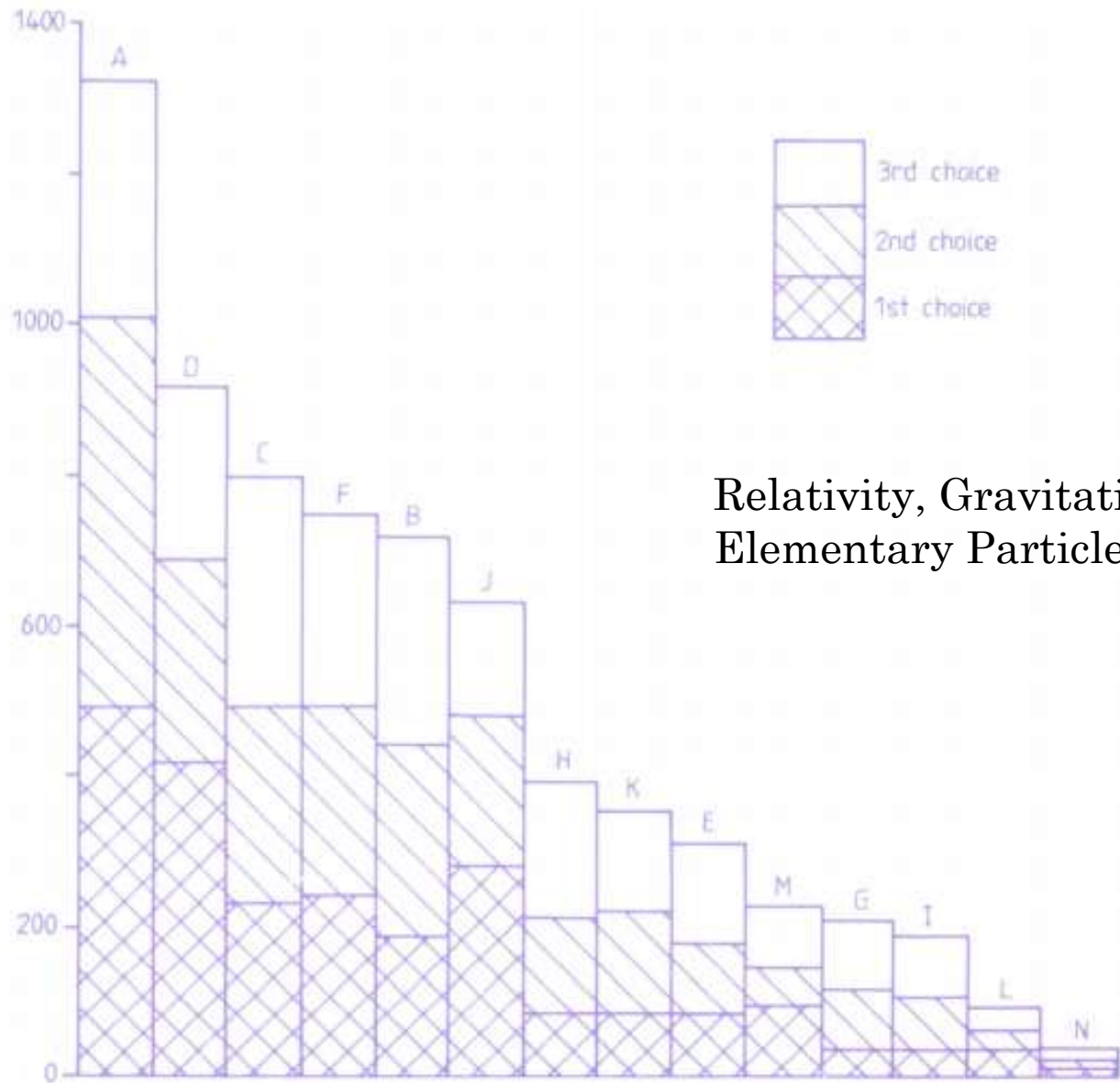


Scientists love their jobs. They wake up in the morning and are excited to come to work. . . . When you are a scientist, you come to work ready to explore and learn new things. Things that may change the world someday. Maybe not today, maybe not tomorrow.



E?





- A Relativity and gravitation
- B Quantum theory, other theoretical physics
- C Elementary particles
- D Astronomy, astrophysics, cosmology, space research
- F The nucleus, nuclear energy
- H Optics
- I Atoms, molecules, chemical physics
- J Electronics
- K Computing

Relativity, Gravitation, Astrophysics and Elementary Particles in students' top 5 list.

SOME TEACHER FEEDBACK

“... (I) had no idea of so many possibilities to address the content that will be worked with the students” (T1)

“I learned a lot; besides learning about particle physics, I also discovered new methods and instructional experiences from other teachers. Students get excited” (T17)

“[the workshop] approaches the teacher to the reality of current researches, providing the elements to contextualize [particle physics]” (T9)



THE VALUE OF TEACHER TRAINING IN FRONTIER SCIENCE

Challenges

Lack of organized
training materials

Teachers not properly
trained in modern science

Lack of active classroom time
to address these topics

Solutions

Teacher Training

- Increases teachers' confidence
- Increases teachers' content knowledge
- Brings together teachers, students, researchers
- Provides high quality training materials



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CHALLENGES AND PROBLEMS

- Lack of organized educational content introducing modern Physics in the classroom in a consistent fashion.
- Lack of teacher training in modern Physics topics.
- Lack of a pedagogical framework and methodology to introduce these topics in the classroom.
- Lack of feedback and systematic communication between educators – researchers as well as between educators with the same passion for introducing Modern Physics in their school.
- Lack of time and curriculum pressure for timely completion of the prescribed syllabus and preparation for exams.
- Lack of support from the state.



THE ROLE OF



- FRONTIERS is a project funded by the Erasmus+ framework of the EU with duration from 2018 to 2021.
- **It aims to address the challenges of introducing frontier Physics in the Classroom.**



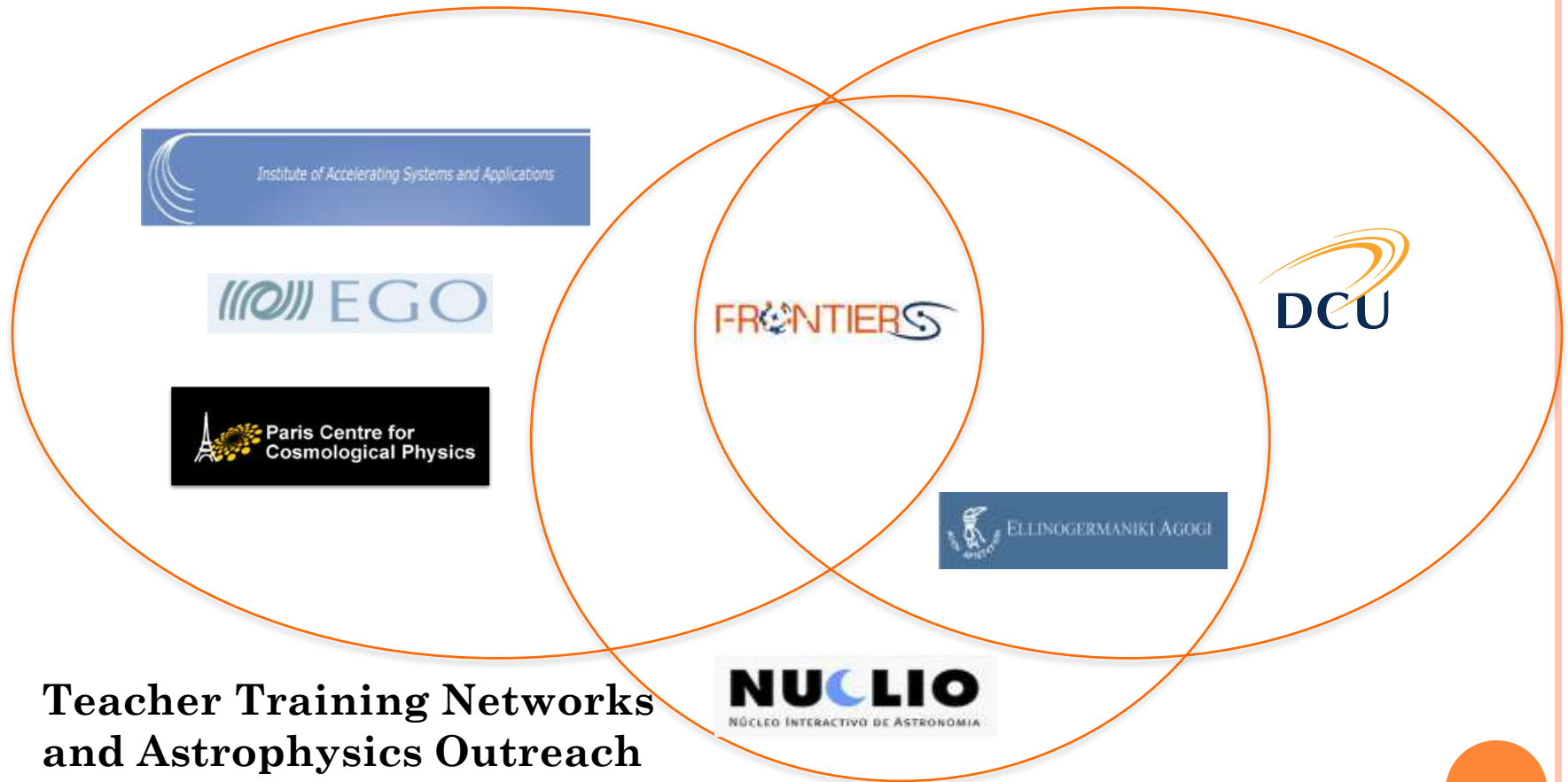
HOW;



BY BRINGING TOGETHER RESEARCH AND EDUCATIONAL INSTITUTIONS FROM ALL OVER EUROPE

Scientific Research

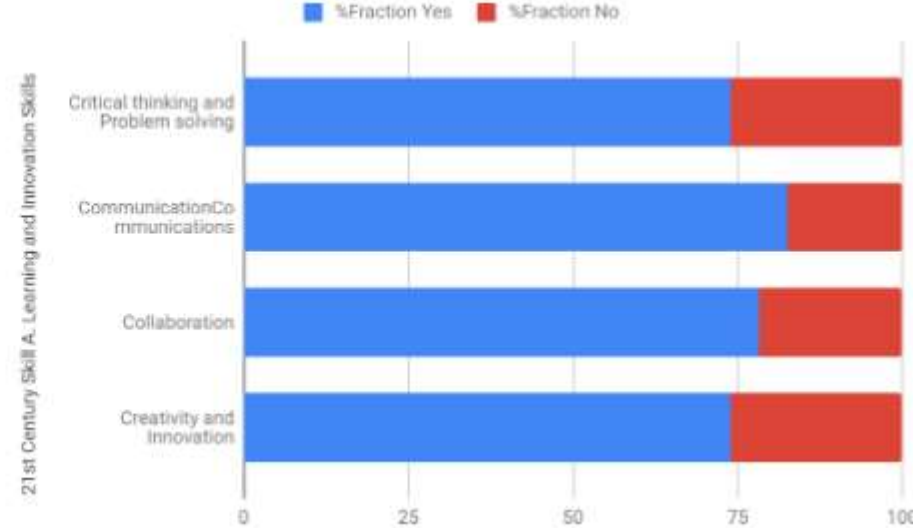
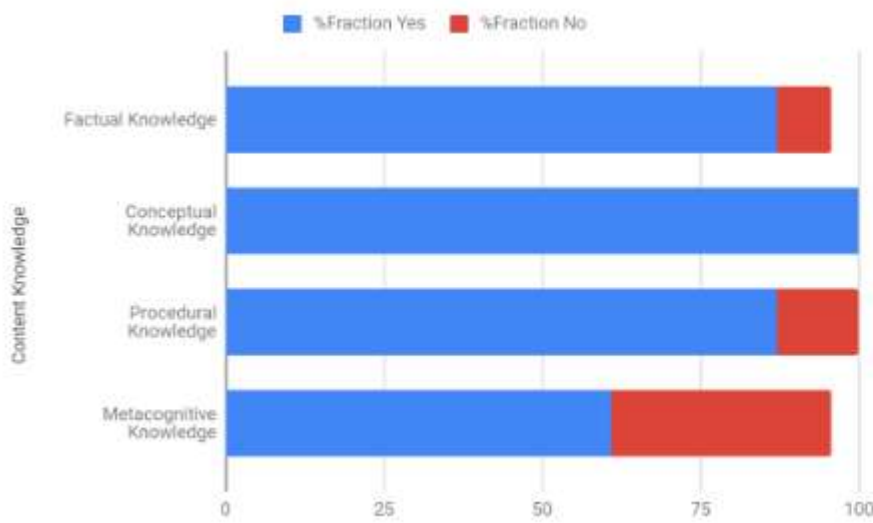
Science Education



Frontiers has been funded within the framework of the European Union Erasmus+ programme



INVESTIGATING ALREADY EXISTENT OUTREACH PRACTICES AND DRAWING LESSONS LEARNT

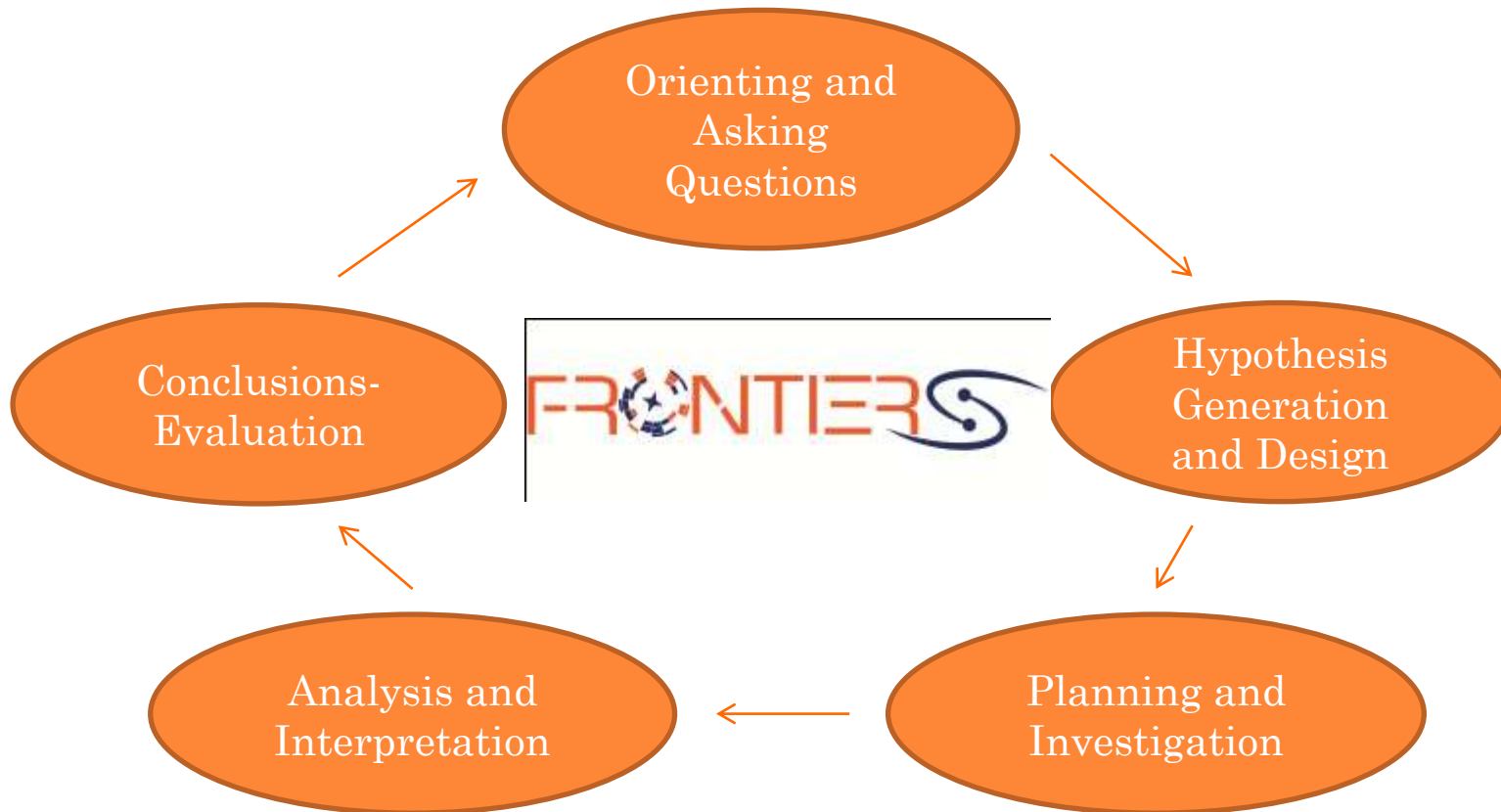


ADOPTING THE INQUIRY BASED SCIENCE EDUCATION PEDAGOGY

- Learners are **engaged** by scientifically oriented questions.
- Learners give priority to **evidence** which allows them to develop and **evaluate explanations** that address **scientifically oriented questions**.
- Learners **formulate explanations** from evidence to address scientifically oriented questions.
- Learners **evaluate their explanations** in light of alternative explanations, particularly those reflecting scientific understanding.
- Learners **communicate and justify** their proposed explanations.



ADOPTING THE INQUIRY BASED SCIENCE EDUCATION PEDAGOGY



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



- **Orienting and Asking Questions**. The topic of the lesson is introduced, assumptions the students may have are challenged, and questions they may have are formulated.
- **Hypothesis Generation and Design**. During which the students develop one of their questions into a hypothesis.
- **Planning and Investigation**. In which the hypothesis previously developed is tested.
- **Analysis and Interpretation**. Where the students analyse the data collected from their investigation and refute or confirm the hypothesis.
- **Conclusion and Evaluation**. When the students communicate their findings.



DEVELOPING THE FRONTIERS

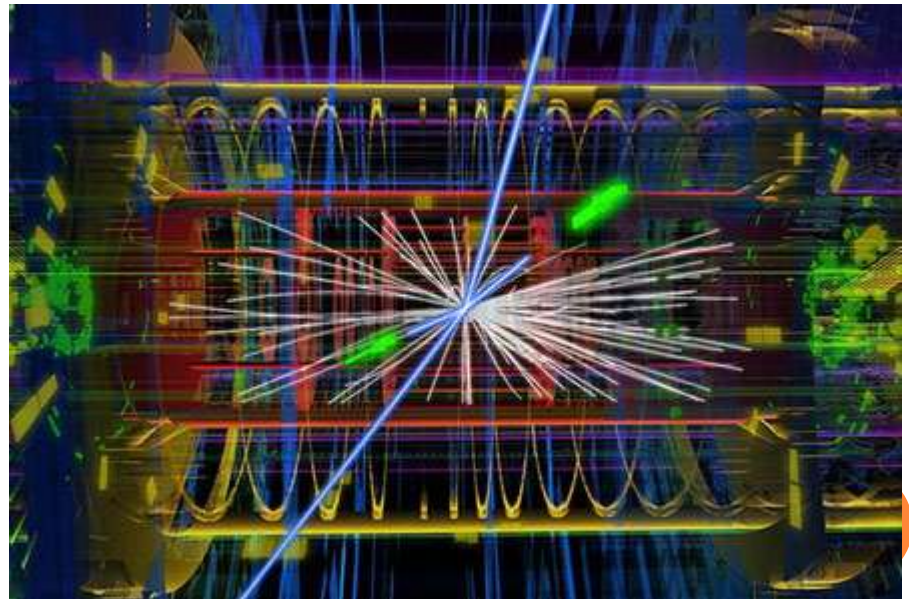
DEMONSTRATORS:

CUTTING EDGE EDUCATIONAL ACTIVITIES FOR YOUR CLASSROOM

FRONTIERS will prepare 20 demonstrator lessons that are about a modern physics topic for secondary school; ready to be used (or adapted); follow an inquiry methodology; available @ ISE platform:

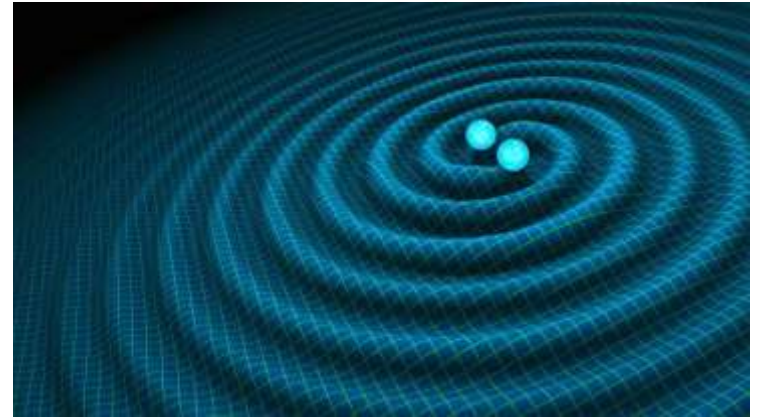
High Energy Physics

- Discover the Z and Higgs Bosons
- World Data Day
- Magnetic Field
- Let's Accelerate particles
- The ALICE Experiment at CERN
- Mass- Energy Equivalence



Gravitational Wave Astronomy

- VIRGO Virtual Visit
- VIRGO Control (Class) Room
- Gravitational Wave Noise Hunting
- Finding black-holes in a chirp”
- The Michelson Interferometer
- Earthquake Interferometer



Astrophysics – Astroparticle Physics



- Black Holes
- Solar Rotation
- Discovering Alien Worlds
- Build your own cloud chamber
- Relativistic Muons and Time Dilation
- Cosmic Rays
- Neutrino Astronomy
- Age of the Universe



Embedding virtual e-science applications

Assessing Problem Solving Skills and Knowledge Items

S_e
Για σου εχαιό!
Αξιολόγηση
ΡΥΘΜΙΣΕΙΣ
ΒΟΗΘΕΙΑ

Ερωτήσεις Επίλυσης Προβλημάτων-Στατιστικά Δεδομένα σε Πραγματικό Χρόνο
 Γνωστικό Αντικείμενο-Στατιστικά Δεδομένα σε Πραγματικό Χρόνο

Αποτελέσματα Ερωτήσεων Επίλυσης Προβλημάτων (ΕΕΠ)
 Αποτελέσματα Γνωστικού Αντικείμενου
Μέσος Χρόνος Τάξης ανά Θέση

Αριθμός Μαθητών που συμμετείχαν στο Μάθημα: **11**
 Αριθμός Μαθητών που απάντησαν σε όλες τις Ερωτήσεις Επίλυσης Προβλημάτων: **12**

ΕΞΑΓΩΓΗ ΔΕΔΟΜΕΝΩΝ
 ΑΝΑΝΕΩΣΗ

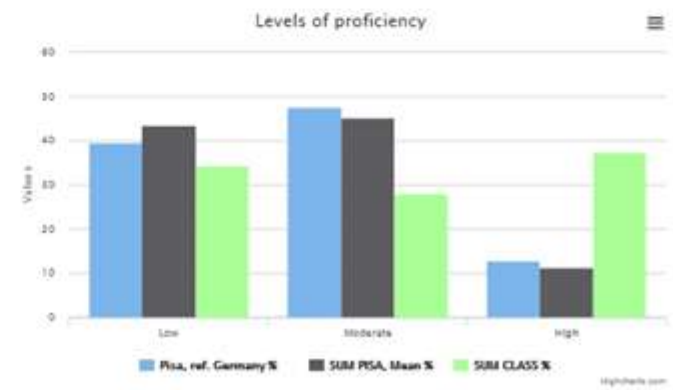
| ΟΝΟΜΑ ΜΑΘΗΤΗ | ΧΑΜΗΛΟ | ΜΕΣΟ | ΥΨΗΛΟ |
|-------------------------------|--------|------|-------|
| Χάρα ¹⁵ | 4 | 2 | 2 |
| Ελισσαί ¹⁵ | 2 | 1 | 1 |
| στου ³ | 3 | 2 | 3 |
| ηλίας ¹⁵ | 2 | 2 | 4 |
| ΚουκοςΑρστούλας ¹⁵ | 2 | 3 | 3 |
| ΜΙΧΑΛΗΣ % | 3 | 1 | 4 |

Ερωτήσεις Επίλυσης Προβλημάτων-Στατιστικά Δεδομένα σε Πραγματικό Χρόνο
 Γνωστικό Αντικείμενο-Στατιστικά Δεδομένα σε Πραγματικό Χρόνο

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 Αποτελέσματα Γνωστικού Αντικείμενου
Μέσος Χρόνος Τάξης ανά Θέση

Χώρες Αναφοράς του PISA
 GERMANY

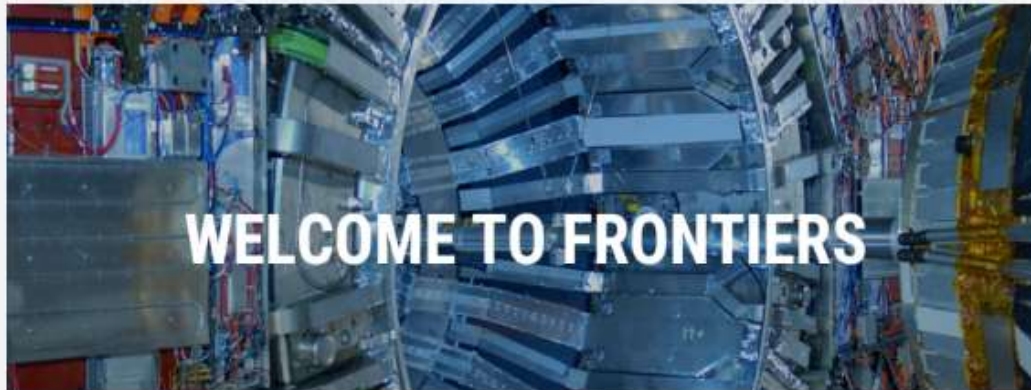
ΑΝΑΝΕΩΣΗ





Bringing Nobel Prize Physics in the Classroom

Domain: Science



Have you ever wondered how we can integrate Modern Physics in the school curriculum? Do you believe that exciting discoveries such as the Discovery of Gravitational Waves or the Discovery of the Higgs Boson can be brought in the classroom in a consistent and understandable fashion? The FRONTIERS Project brings together expertise from frontier scientific research and educational research in formal and informal science learning, along with user communities across Europe, in order to demonstrate how Nobel Prize winning science can be systematically integrated in the school curriculum.

How do I join the FRONTIERS team?

Make your registration (by clicking on register on the top of the page) and press [join community](#) Your journey just began!

You can also join the FRONTIERS communities in [France](#), [Greece](#), [Ireland](#), [Italy](#) and [Portugal](#)!

What are the benefits of joining the FRONTIERS team?

- You will have access to a wealth of [educational resources](#) introducing concepts from Astrophysics and Gravitational Wave Astronomy to Particle and Astroparticle Physics using real data!!
- You will be able to organize virtual visits in Large Research Infrastructures such as CERN and VIRGO for your students!!

Leave

Invite

Customize Community

New sub-community

Managed By:

Emmanuel Chaniotakis



Created on: 16.04.2019

Last visited: 13.06.2019

Network of related communities



ed



FRONTIERS:
Bringing Nobel
Prize Physics in the
Classroom

Δημόσια ομάδα



Αλληλεπίδραση ως
Frontiers Project

Πληροφορίες

Συζήτηση

Μέλη

Φωτογραφίες

Συντονισμός ομάδας

Ποιότητα ομάδας

Αναζήτηση στην ομάδα

Συντομεύσεις

Σεμινάρια Σύγχρον... 20+

ΕΛΛΗΝΕΣ ΕΚΠΑΙΔ... 20+

Teachers from Eur... 20+

Galileo Teachers Gr... 2

ΦΥΣΙΚΗ .- 2

Thank you, Next 20+



Είστε μέλος ▾

✓ Ειδοποιήσεις

➔ Κοινοποίηση

⋮ Περισσότερα

✎ Δημοσιεύστε κάτι
⋮ Περισσότερα

📷 Φωτογραφία/βί...

📺 Live βίντεο

👤 Γράψτε κάτι...

📷 Φωτογραφία...

🍿 Ομαδική προ...

🗨️ Ζητήστε προ...

⋮



Βοηθήστε την ομάδα να αναπτυχθεί

Βοηθήστε να αναπτυχθεί αυτή η ομάδα προσκαλώντας φίλους σας ή κοινοποιώντας την σε άτομα που μπορεί να ενδιαφέρονται να ανακαλύψουν μια νέα κοινότητα.

ΟΜΑΔΑ ΑΠΟ



Frontiers Project

Αρέσει σε 290 άτομα

ΚΑΤΗΓΟΡΙΟΠΟΙΗΣΗ ΔΗΜΟΣΙΕΥΣΕΩΝ

+ Δημιουργία θέματος ✕

Προσθέστε θέματα σε δημοσιεύσεις για να βοηθήσετε τα μέλη της ομάδας να βρουν τις πληροφορίες που τους ενδιαφέρουν.

ΠΡΟΣΚΛΗΣΗ ΜΕΛΩΝ

Προσκαλέστε άτομα που τους αρέσει η Σελίδα σας, Frontiers Project, να γίνουν μέλη αυτής της ομάδας.

📧 Πρόσκληση

ΜΕΛΗ

9 μέλη

<https://portal.opendiscoveryspace.eu/en/community/frontiers-community-france-855299>

OFFERING CONTINUOUS TRAINING AND SUPPORT FOR THE IMPLEMENTATION OF FRONTIERS ACTIVITIES IN YOUR CLASSROOM



[HOME](#) [ABOUT](#) [PROGRAMME](#) [VENUE](#) [REGISTRATION](#) [ORGANIZERS](#) [CONTACT](#)

Frontiers Summer School



IF..

- You believe that it is worthwhile to introduce topics such as the discovery of Gravitational Waves or of the Higgs Boson

We invite you to become members of the FRONTIERS family!

these scientific topics.

- You want to become part of our international community of educators and researchers with who you will be able to interact, collaborate, exchange ideas and practices.



Throughout your engagement with FRONTIERS you will be offered continuous support and training, you will receive online badges and you will be able to participate in educational competitions with great prizes!

- Subscribe to our newsletter!
- Register to the project and become a FRONTIERS teacher: <http://bit.ly/join-FRONTIERS>
- Contribute to our Facebook group!
- Participate in our training workshops to be announced soon!
- Implement at least one FRONTIERS activity in your classroom!



THANK YOU VERY MUCH

For further details visit:

FRONTIERS website:

www.frontiers-project.eu

Facebook page:

<https://www.facebook.com/frontierseu>

Facebook group:

<https://www.facebook.com/groups/665957563876838/>

Don't hesitate to contact us : info@frontiers-project.eu

