

SUMMARY OF
SPECIAL
SESSION:
DIVERSITY,
OUTREACH &
EDUCATION

Matteo Cadeddu

Francesca Dordei

Matteo Tuveri

INFN Cagliari



NuFact 2021, 6-11 September, Cagliari (Italy)

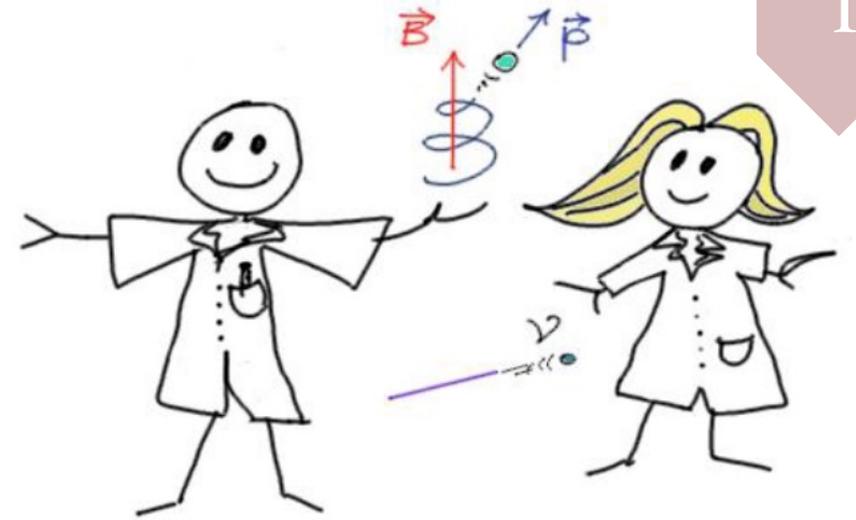
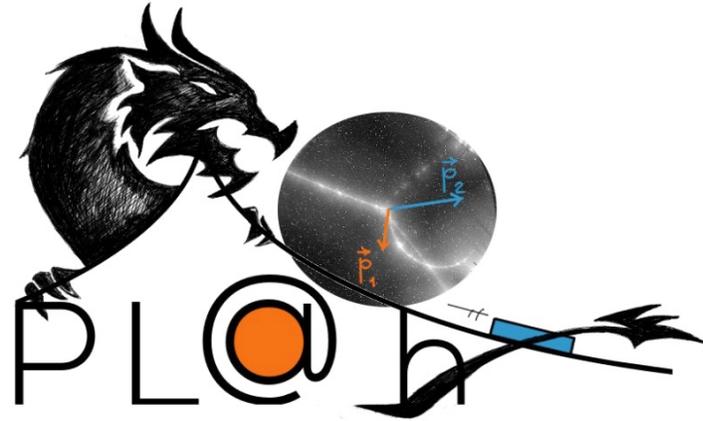
A VERY
SPECIAL
AND RICH
SESSION

First time of such a session for NuFact!

09:00	Particle Physics Role Play Games in introductory physics courses	<i>Lorenzo Galante</i>	
	<i>THotel</i>		09:00 - 09:20
	Creativity at its best: making science by making art	<i>Matteo Tuveri</i>	
	<i>THotel</i>		09:20 - 09:40
	Warning!": an interdisciplinary project to discuss about the big planetary threats	<i>Enrico Mazzoni</i>	
	<i>THotel</i>		09:40 - 10:00
10:00	Analysis of the management of conference presentations in the CMS collaboration	<i>Arnd Meyer</i>	
	<i>THotel</i>		10:00 - 10:20
	Involving the new generations in Fermilab future endeavours	<i>Simone Donati</i>	
	<i>THotel</i>		10:20 - 10:40
	New particle search with the REINFORCE citizen science project	<i>Christine Kourkoumelis</i>	
	<i>THotel</i>		10:40 - 11:00
11:00	How high school teachers can help narrow the gender gap in STEM education	<i>Niharika Kulshresth</i>	
	<i>THotel</i>		11:00 - 11:20
	Discussion session		
	<i>THotel</i>		11:20 - 11:45

<https://indico.cern.ch/event/855372/timetable/-/20210910.detailed>

Particle Physics Role-Playing Games in introductory Physics Courses.



Lorenzo Galante^{1, 2}, Ivan Gnesi^{2, 3, 4}
lorenzo.galante@polito.it

Students play the role of particle physicists

18-hours course

“From Conservation Laws to Scientific Discovery”

Why Role-Playing Games?

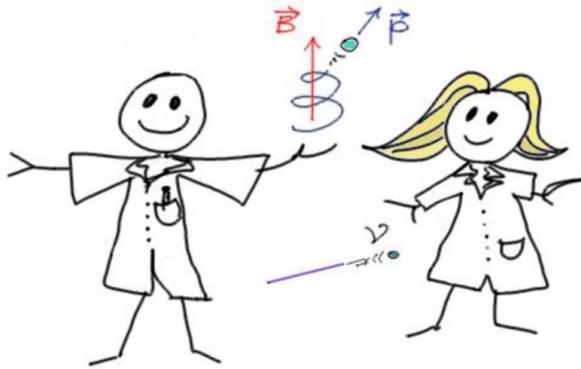
- Active Learning
- Identification with what is being studied
- Motivation in the study of introductory Physics

In the game the students have the **power to explore the beauty of what is being studied**, rather than studying to mainly pass an exam!

PARTICLE PHYSICS ROLE-PLAYING GAMES IN INTRODUCTORY PHYSICS COURSES

“From Conservation Laws to Scientific Discovery”

(18 hours)



2 Role-Playing Games

1. A case from 20th century physics

Momentum and Energy
Conservation Laws

The neutrino hypothesis
(neutron beta decay in the 30s).

Momentum and Energy
Conservation Laws

Discover the undetected particle
emitted in a (π - He) collision

2. Nuclear Collisions

PARTICLE PHYSICS ROLE-PLAYING GAMES IN INTRODUCTORY PHYSICS COURSES

Distance Learning Supporting Technology

- 1) Zoom Meetings
- 2) Interactive supporting site
 - The site is full of interactive sections



The physics of the game

PART 1

Preparatory meeting for
the Role-Playing game

PART 2

The Game

What do you think about using a role-playing game for a physics course?

99 Answers

All with a positive feedback

“It made everything more exciting”

“I think it is very useful to push for deeper thinking.”

“It appeared to be a very 'light' and engaging way of approaching complex topics.”

Creativity at its best: making science by making art

High School Student project

<https://artandscience.infn.it>
<https://www.facebook.com/artandscienceacrossitaly>
 Instagram
 YouTube channel
 Library

Matteo Tuveri

*Istituto Nazionale
 di Fisica Nucleare
 of Cagliari*

*On behalf of A&S
 coordination
 committee*

In a glance:

- **Arts-based activities** important to **integrate creativity, imagination, and science in school settings.**
- Inclusion of a **competition element**
- One of the pillars of the scientific research is **working in teams**; to collaborate, to share ideas and personal skills. Students divided in teams.

Italian high school students (15-18 years old)

Art & Science Across Italy, is organized and funded by the Italian National Institute for Nuclear Physics (INFN) and by CERN.

III edition (2020-2022) is on going now

Physics, Chemistry, Math, Biology, Oceanography, Engineering, Art, Literature, Medicine and more

All the info at: <https://artandscience.infn.it>

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

<https://www.instagram.com/artandscienceacrossitaly/>



Educational phase (6 months)

- Seminars
- Museum visits
- Laboratory visits
- Round tables
- Photo/Video contest
- Movies and doc.



Creative phase (3 months)

- Group of 3 students design an artistic project
- One scientific theme
- No restriction or boundary
- Any artistic form is welcome



Exhibition & Competition

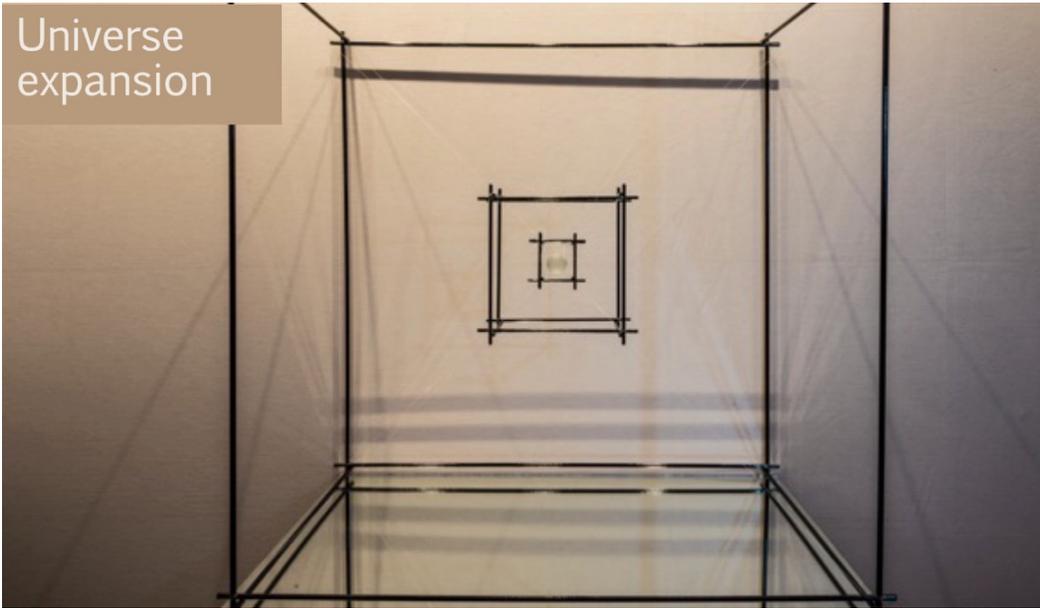
- All artworks are shown at local exhibitions
- The first 7 gain the National competition
- Students act as guide for the public



Master at CERN/INFN

- 24-30 fellowships for the A&S Master
- 5 days long
- II edition at LNF

Universe
expansion



Color
Accelerator



CREATIVITY AT ITS BEST: MAKING SCIENCE BY MAKING ART

- Large variety of cultural interest; 10 were interested in scientific field, 3 in medicine, 2 in art, 4 in human field.
- All the students have the same probability to have success in the project regardless the type of high school they come from.

Warning

From physics to an interdisciplinary project to discuss with students about the big planetary threats

Franco Cervelli, Sandra Leone and Enrico Mazzoni

- To draw attention of new generations to natural events potentially threatening the whole mankind, Fondazione Pisa and Italian Institute for Nuclear Physics launched this initiative, a knowledge dissemination project, which took place between December 2020 and May 2021

The context

Pandemics (like Sars-CoV-2) are not the only sources of risk at planetary level.

- 20% of the Earth is permanently vulnerable to highly dangerous natural hazards
- More than 30% of European population lives in highly dangerous areas
- Large geographic regions are exposed to multiple types of serious natural risks

WARNING: FROM
PHYSICS TO AN
INTERDISCIPLIN
ARY PROJECT TO
DISCUSS WITH
STUDENTS
ABOUT THE BIG
PLANETARY
THREATS

The organization

- Due to the pandemic all events took place **virtually**
- More than 3000 students from 25 High Schools
- Explanatory material in digital form was made available before the debates
- Students were asked to prepare and present their questions in advance
- On average **600 questions were collected for each seminar** an accurate work of classification and selection was necessary
- For each «seminar» the speakers were **two scientists/researchers with complementary and interdisciplinary expertise**
- Each «seminar», lasted 2-3 hours. A significant part of the seminars was devoted to answering student questions.

<https://warning.palazzoblu.it/>

WARNING: FROM PHYSICS TO AN INTERDISCIPLINARY PROJECT TO DISCUSS WITH STUDENTS ABOUT THE BIG PLANETARY THREATS

The five events subjects

Alarms from the atmosphere



Major biological hazards



The restless earth



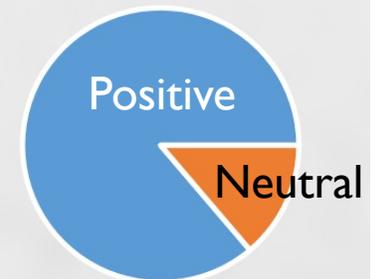
Wonders and hidden dangers from space



Climate and oceans: sinister changes



General on the project



FEEDBACK ||

CMS Conference Presentations: Analysis

Introduction
A special year
Analysis of conference data

Arnd Meyer (RWTH Aachen IIIA)
for the CMS conference committee

CMS has a standing committee to organize the representation of CMS at scientific fora, comprised of up to 20 members incl. ex-officio

- Pursue the goal of an equitable distribution of talks
- Promote and maintain a high standard of CMS presentations

Balance

- Best possible representation of CMS to the outside world
- Benefits/needs of individual CMS members

> **16000 presentations in >13 years** – wealth of data and unique experiences from one of the largest scientific collaborations today

CMS CONFERENCE PRESENTATIONS

Presentantion history



All recorded presentations:
talks+posters,
international+national,
major conferences, workshops, ...

All talks at international
conferences and workshops
(excluding instrumentation confs.)

All talks at major international
conferences (Moriond QCD+EW,
ICHEP, EPS-HEP, LHCP, QM, LP, SUSY)

50% of a “normal” year (except major conferences)

Also **some benefits:** speakers
(and others) attending
conferences in “places” they
would otherwise have little
chance to visit

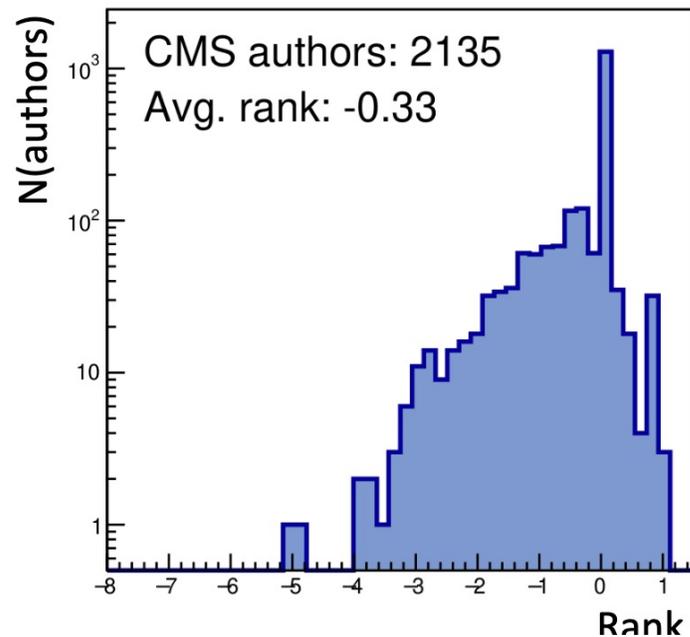
**New forms of online exchange
developed:** breakout rooms, virtual
coffee breaks, virtual poster
sessions, various social media
platforms, etc.

- Beneficial for the future
- No replacement for “real” conferences
- Exciting prospects for much more varied scientific fora than ever before

CMS CONFERENCE PRESENTATIONS

Geographical diversity and balancing

- Reasonable for most “larger” countries (in CMS)
- Among those, Russia, China, and India below average
- Some “smaller” countries low



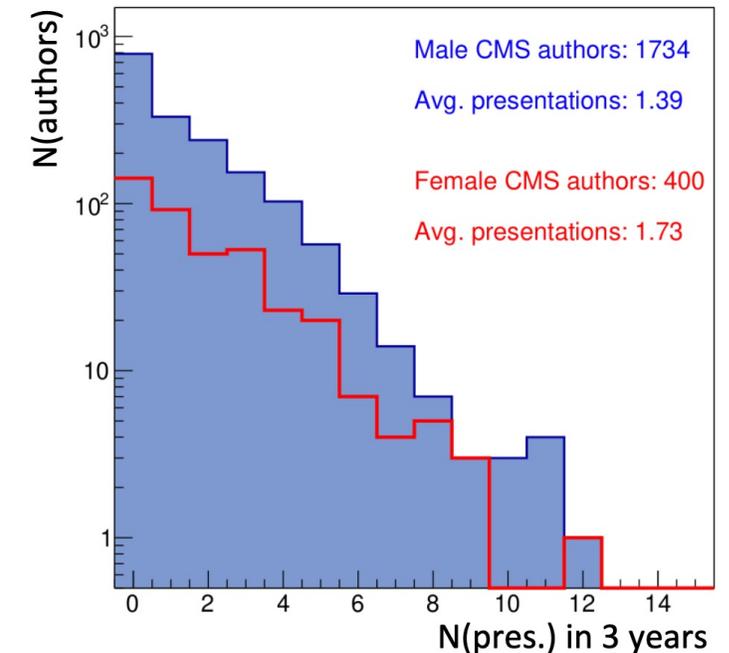
The rank of CMS authors is **-0.33**
on average (covers ~2018-20)

2018 (~2016-18): -0.52

2017 (~2015-17): -0.49

“Rank”: summarizes talk history of last 3 years, including weights by type of talk and conference and other factors.
More talks → smaller rank (details in backup)

Gender representation



2020 (~2018-2020)

Procedures in place for a fair distribution of talk opportunities

Involving the New Generations in Fermilab Future Endeavors



Emanuela Barzi, Giorgio Bellettini,
Simone Donati, Daniele Pasciuto

University and INFN Pisa



UNIVERSITÀ DI PISA

Students' Recruitment

INTERNATIONAL PROGRAM

- Applications from most Italian and some European Universities

MASTER STUDENTS

- Physics/Applied Physics
- Engineering, Materials Science
- Computer Science

ADMISSION

- Curriculum Vitae
- Recommendation Letters
- Interview
- Good knowledge of English

THE ITALIAN SUMMER STUDENTS PROGRAM @FERMILAB

- A multi-disciplinary **9-week internship** for Physics and Engineering students
- Hands-on training on Fermilab high-tech research



INVOLVING
THE NEW
GENERATIONS
IN FERMILAB
FUTURE
ENDEAVOURS

Training Programs

AUGUST – SEPTEMBER (9 WEEKS)

PROGRAMS FOR PHYSICISTS

- Design, construction, commissioning of particle detectors/accelerators
- Simulation of particle detectors/accelerators and particle physics experiments
- Analysis of data collected by particle physics experiments

PROGRAMS FOR ENGINEERS

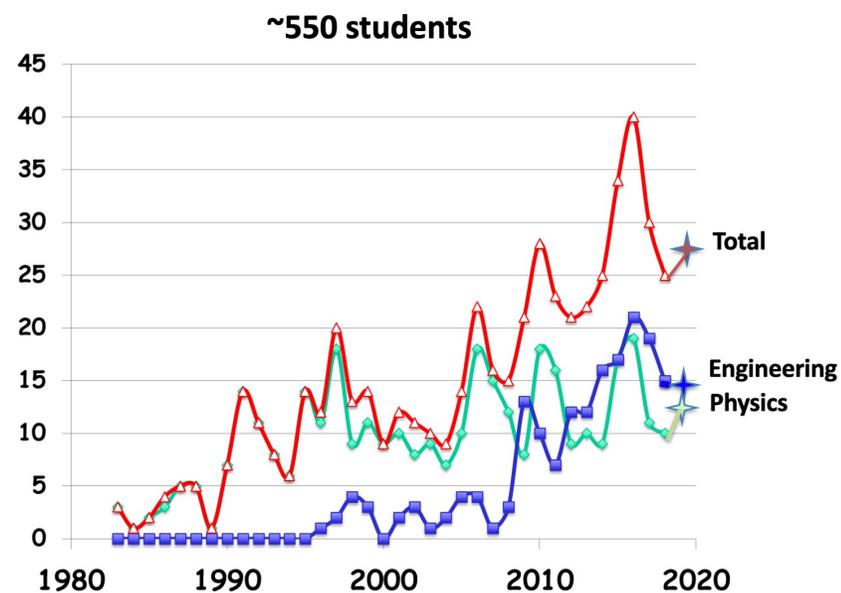
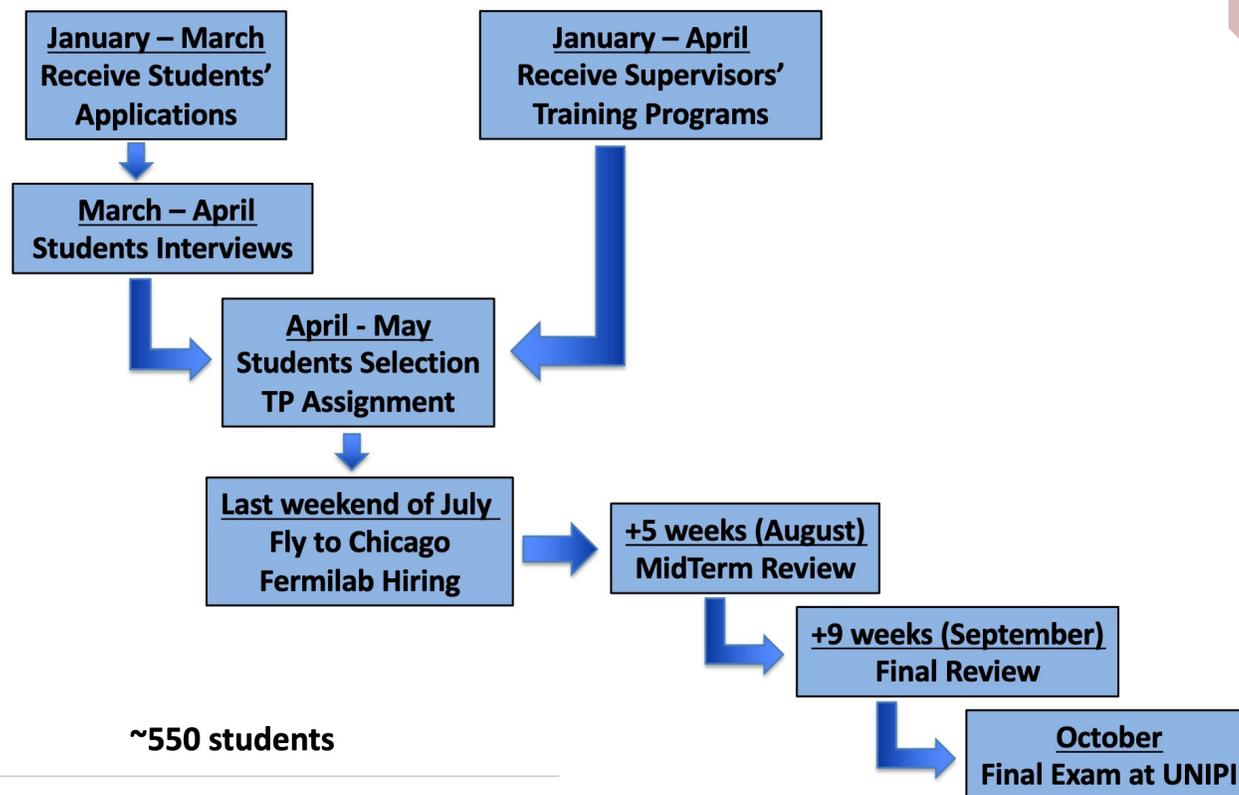
- Design/Test of particle detectors/accelerator components
- Design/Test of superconducting materials and magnets for particle accelerators
- Development of fast electronics components/high precision mechanics
- Development of advanced computing infrastructures

UNIVERSITY CREDITS (acknowledged by the UNIFI Summer School)

- 6 ECTS credits (ECTS, European Credit Transfer and Accumulation System)

INVOLVING
THE NEW
GENERATIONS
IN FERMILAB
FUTURE
ENDEAVOURS

Important Actions/Dates



- Completely free for students!
- In 2021 3-DAY Full Immersion Workshop
- Many summer students developed their career at Fermilab with a Master Thesis and a PhD!

The search for new long-lived particles at CERN with the REINFORCE EU Citizen-Science project

NuFact 2021

September 10, 2021

Christine Kourkoumelis
on behalf of the REINFORCE consortium

- The REINFORCE project (Research Infrastructures FOR Citizens in Europe) aims to engage and support citizens to cooperate with researchers and actively contribute in the development of new knowledge for the needs of science and society. The site is <http://www.reinforceeu.eu/>
- REINFORCE is built on the Zooniverse platform
- Examples: HiggsHunters, GravitySpy, MuonHunters

THE SEARCH FOR NEW LONG-LIVED PARTICLES AT CERN WITH THE REINFORCE EU CITIZEN-SCIENCE PROJECT

GRAVITATIONAL WAVE NOISE HUNTING

Leader: EGO/ U. of Pisa
Data from Virgo and LIGO
Identify “glitches”

The project “**Glitch Hunters**” developed on Zooniverse platform aims to improve the knowledge of **noise sources**

DEEP SEA HUNTERS

Leader: CNRS
Data from KM3NeT
Neutrino detection,
Noise sources from bioluminescence, and bioacoustics(dolphins, whales, etc).

SEARCH FOR NEW PARTICLES AT THE LHC

New project!



To have citizens focus on **visual inspection of events**



To train citizens to identify different kind of particles, locate **displaced vertices** and make **possible discoveries of “new physics”**

We chose to invite citizen scientists to study data produced from proton-proton collisions at the LHC, and collected by the huge ATLAS experiment ([link](#))

It is finalized and its platform is under review!

+ many more in the presentation!

THE SEARCH FOR NEW LONG-LIVED PARTICLES AT CERN WITH THE REINFORCE EU CITIZEN-SCIENCE PROJECT

PLUS:

Explore the potential of frontier citizen science for **inclusion and diversity**.

Last but not least: WP on inclusion and diversity

Leader: EGO/



Argentina

- The aim is to include sense-impaired people (especially visual-impaired) and senior citizens
- We are already discussing with Wanda how to make accessible the particle identification part (Stage 2)**
- The data will be sonified
- Sonification software(SonoUno)*
<https://pypi.org/project/sonoUno/>
- We also aim to cross-connect artists with scientists



Wanda Diaz Merced

How High School Teachers can help narrow the gender gap in STEM Education

Niharika Kulshreshtha
The Scindia School
Fulbright Scholar 2011-'12

India scenario

- Only 3% of women enrol in PhD in Science and six percent opt for a PhD in Engineering and Technology.
- They account for only 14% of the total scientists, engineers, technologists in research development institutions.

Global scenario

- According to the UNESCO ground-breaking report Cracking the code: Girls' and women's education in STEM, only 35% of STEM students in higher education globally are women, and differences are observed within STEM disciplines.
- For example, only 3% of female students in higher education choose information and communication technologies (ICT) studies.

HOW HIGH SCHOOL TEACHERS CAN HELP NARROW THE GENDER GAP IN STEM EDUCATION

Why it matters?

- STEM careers are the jobs of the future
- The under-representation of women in STEM puts them at a high risk of being displaced by technology.
- 49.6% of the world population is female: Lost potential

Role of High-School teachers

Teachers can play a significant role in dissipating stereotypes in STEM education.

- Catch them Young
- Female Role Models
- Training teachers for gender – sensitive classrooms
- Beware of stereotypes!
- ...

CONCLUSIONS

- Terrific session with many interesting contributions! Thanks to all the speakers!!
- We hope that this session could become a permanent appointment also in the next editions of NuFact.

Two personal additions:

1 Let's all remember that we are coming from 2 difficult years and that especially young students and researchers with non-permanent positions are being affected.

See <http://cds.cern.ch/record/2752585/files/LHCb-PUB-2021-004.pdf>

2 Still a long way to go to fully achieve gender and geographical diversity in physics. Let's keep moving in the right direction!!

- About 440 people registered @NuFACT 2021
 - Among those, 317 specified the pronoun to be used

