



# Introduction to CERN and the Bulgarian Participation in its Activities

## STEM Education Programs and Opportunities for Bulgarian Students and Teachers at CERN

IPPOG Spring Meeting – Teachers and Students Public Event, Sofia, Bulgaria

12 May 2023

Zornitsa Zaharieva

CERN – European Organization for Nuclear Research



Globe of Science and Innovation at CERN

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  5. Masterclasses in Physics and other international competitions
- III. Direct results and impact from the Bulgarian outreach programs
- IV. New Outreach projects at CERN – Science Gateway



# CERN – The Beginning ...

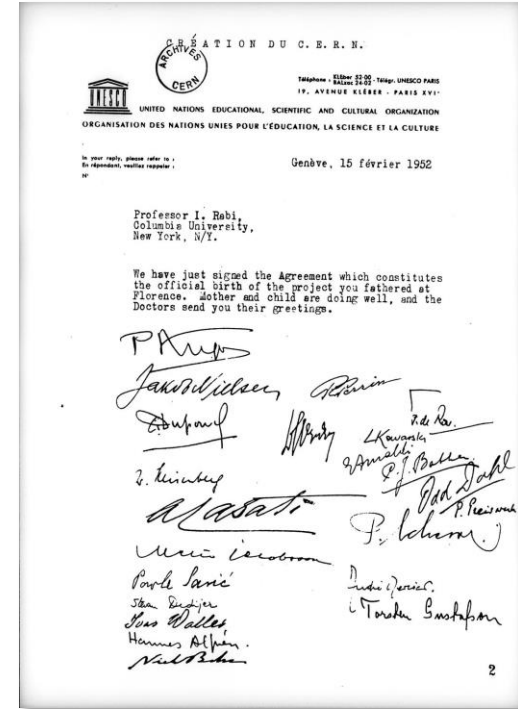
- Aim...** To unite the efforts of European countries in physics research  
**‘Science for Peace’**
- When...** 1954 (1952)
- Founders...** 12 European countries
- Where...** next to Geneva
- The name...** CERN - *Conseil Européen pour la Recherche Nucléaire*



Zornitsa Zaharieva (CERN)



12.05.2023





# CERN – Today

- ✓ The world's largest particle physics research laboratory





# CERN – European Organization for Particle Physics Research

- Pure scientific research into the laws of nature
- Providing to particle physicists from all over the world:
  - **Accelerators** → accelerate particles to almost the speed of light and boost them to higher energies
  - **Detectors** → make the particles visible
- Leading edge in developing technologies  
... and



## 23 Member States

Austria – Belgium – Bulgaria – Czech Republic  
Denmark – Finland – France – Germany – Greece  
Hungary – Israel – Italy – Netherlands – Norway  
Poland – Portugal – Romania – Serbia – Slovakia  
Spain – Sweden – Switzerland – United Kingdom

## 3 Associate Member States in the pre-stage to membership

Cyprus – Estonia – Slovenia

## 7 Associate Member States

Croatia – India – Latvia – Lithuania – Pakistan  
Türkiye – Ukraine

## 6 Observers

Japan – Russia (suspended) – USA  
European Union – JINR (suspended) – UNESCO



CERN's annual budget  
1200 MCHF  
(equivalent to a medium-sized European university)

As of 31 December 2021

Employees:

**2676 staff, 783 fellows**

Associates:

**11 175 users, 1556 others**

## Around 50 Cooperation Agreements with non-Member States and Territories

Albania – Algeria – Argentina – Armenia – Australia – Azerbaijan – Bangladesh – Belarus – Bolivia  
Bosnia and Herzegovina – Brazil – Canada – Chile – Colombia – Costa Rica – Ecuador – Egypt – Georgia –  
Honduras – Iceland – Iran – Jordan – Kazakhstan – Lebanon – Malta – Mexico – Mongolia – Montenegro –  
Morocco – Nepal – New Zealand – North Macedonia – Palestine – Paraguay – People's Republic of China –  
Peru – Philippines – Qatar – Republic of Korea – Saudi Arabia – Sri Lanka – South Africa – Thailand – Tunisia –  
United Arab Emirates – Vietnam

## Distribution of all CERN Users by the country of their home institutes as of 31 December 2021



Geographical & cultural diversity  
Users of **110 nationalities**  
**19.4% women**

### Member States 6642

Austria 74 – Belgium 122 – Bulgaria 39 – Czech Republic 227  
Denmark 42 – Finland 71 – France 811 – Germany 1129  
Greece 133 – Hungary 69 – Israel 67 – Italy 1423  
Netherlands 157 – Norway 69 – Poland 278 – Portugal 89  
Romania 105 – Serbia 36 – Slovakia 66 – Spain 328  
Sweden 88 – Switzerland 372 – United Kingdom 847

### Associate Member States in the pre-stage to membership 55

Cyprus 10 – Estonia 24 – Slovenia 21

### Associate Member States 367

Croatia 36 – India 130 – Latvia 11 – Lithuania 12 – Pakistan 30  
Türkiye 122 – Ukraine 26

### Observers 2917

Japan 189 – Russia (suspended) 971 – United States of America 1757



Numbers for Bulgaria  
• 72 users

### Non-Member States and Territories 1194

Algeria 3 – Argentina 16 – Armenia 10 – Australia 20 – Azerbaijan 3 – Bahrain 2 – Belarus 24 – Brazil 106  
Canada 189 – Chile 23 – Colombia 18 – Cuba 3 – Ecuador 6 – Egypt 16 – Georgia 36 – Hong Kong 17  
Iceland 3 – Indonesia 6 – Iran 11 – Ireland 6 – Jordan 5 – Kuwait 5 – Lebanon 15 – Madagascar 1  
Malaysia 4 – Malta 2 – Mexico 48 – Montenegro 5 – Morocco 18 – New Zealand 8 – Oman 1 – People's  
Republic of China 314 – Peru 2 – Philippines 1 – Republic of Korea 113 – Singapore 3 – South Africa 52  
Sri Lanka 10 – Taiwan 45 – Thailand 18 – United Arab Emirates 6





## Bulgaria – CERN 20<sup>th</sup> Member State

- Bulgaria becomes a member states of CERN after the Bulgarian Parliament ratified the convention for membership at CERN and it is given to UNESCO on the 11th June 1999.
- At the 113<sup>th</sup> session of the CERN Council, the Bulgarian flag is raised next to the flags of the other member states of the CERN.



Zornitsa Zaharieva (CERN)

12.05.2023



IPPOG Collaboration Meeting – Teachers and Students Public Event

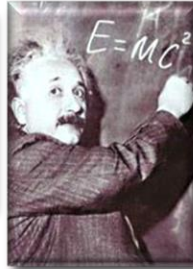
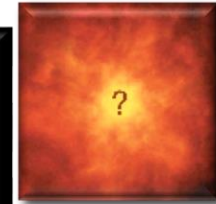
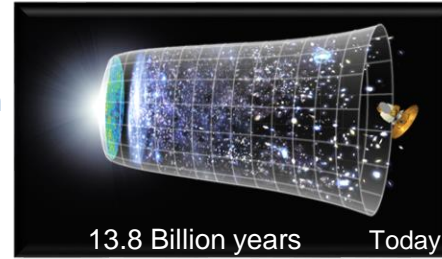
# The Missions of CERN

## ✓ Push the frontiers of **knowledge**

E.g. the secrets of the Big Bang ... What was the matter like within the first moments of the Universe's existence?

What is 96% of our Universe made of?

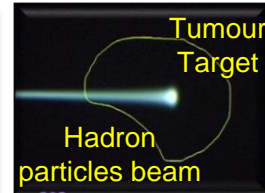
Matter-antimatter asymmetry problem, etc. ...



## ✓ Develop **new technologies** for accelerators and detectors => **technology transfer**

E.g. Information technology - the Web and the GRID

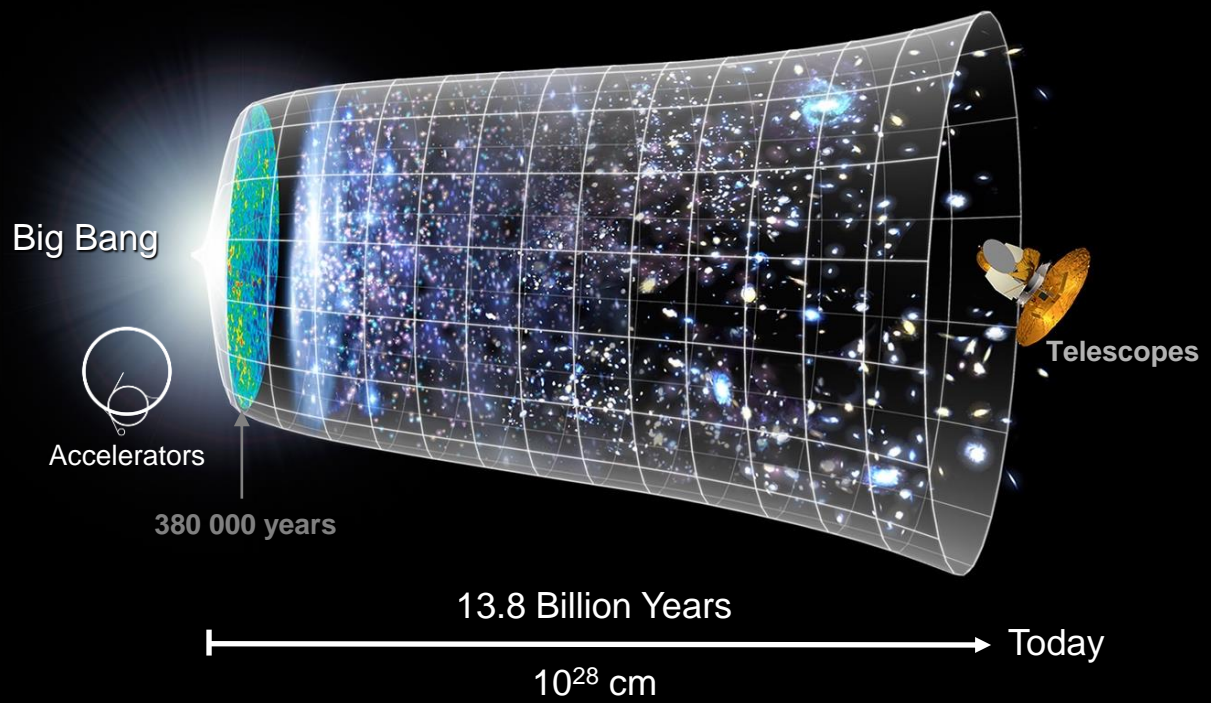
Medicine – diagnosis (e.g. PET scanners) and cancer therapy



## ✓ **Train scientists and engineers** of tomorrow

## ✓ Unite people from different countries and cultures - **114 nationalities**

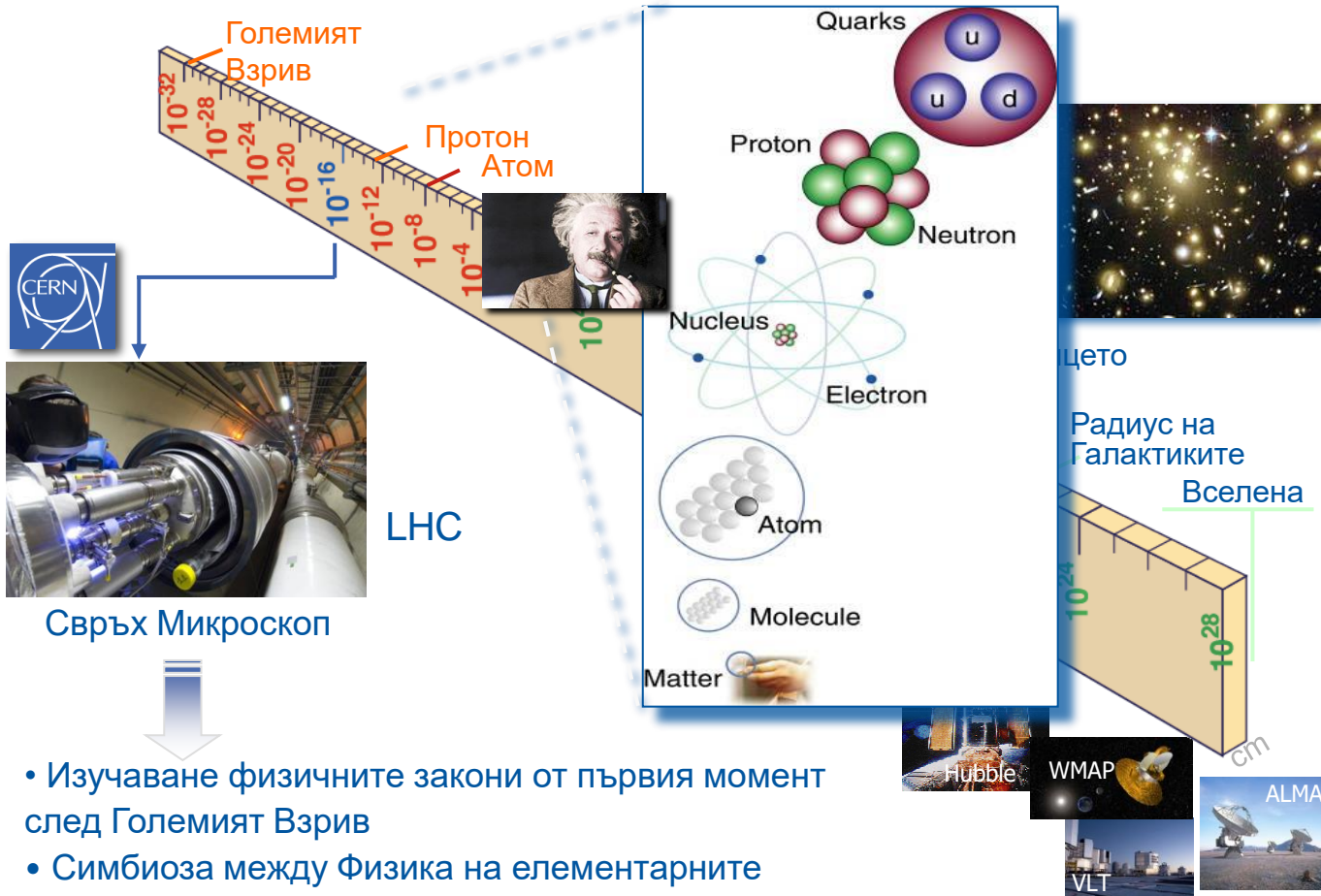




# How did the Universe begin?

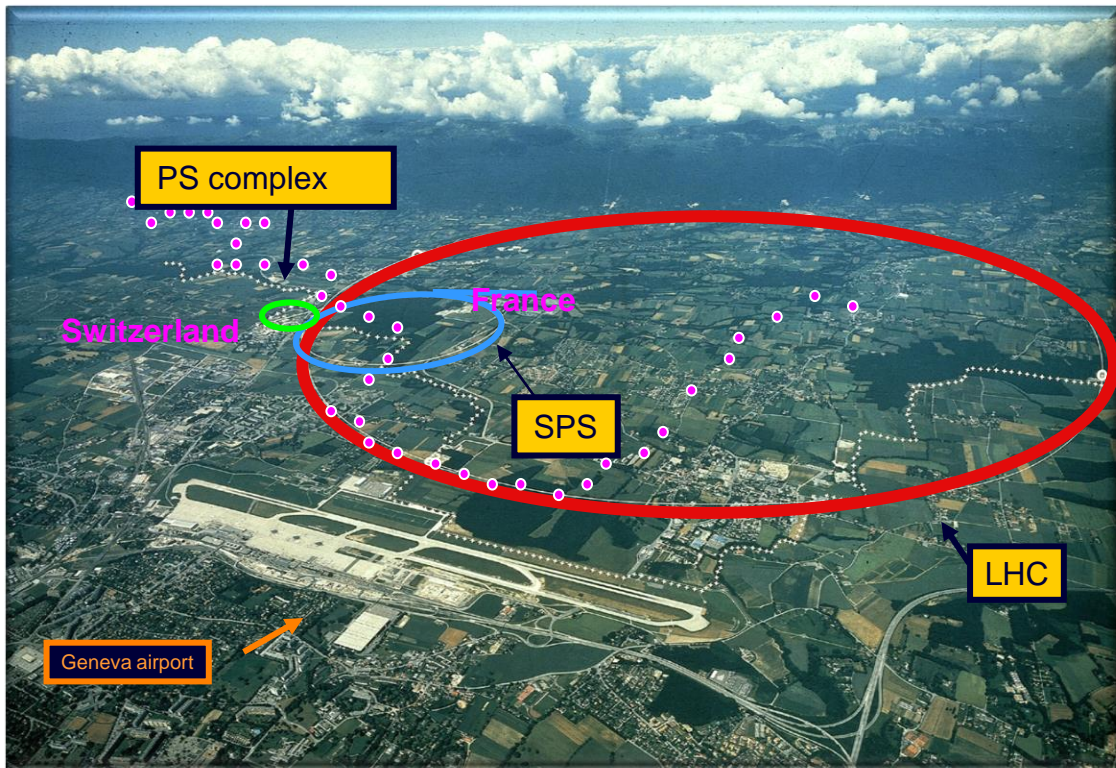
- We reproduce the conditions a fraction of a second after the Big Bang, to gain insight into the structure and evolution of the universe.





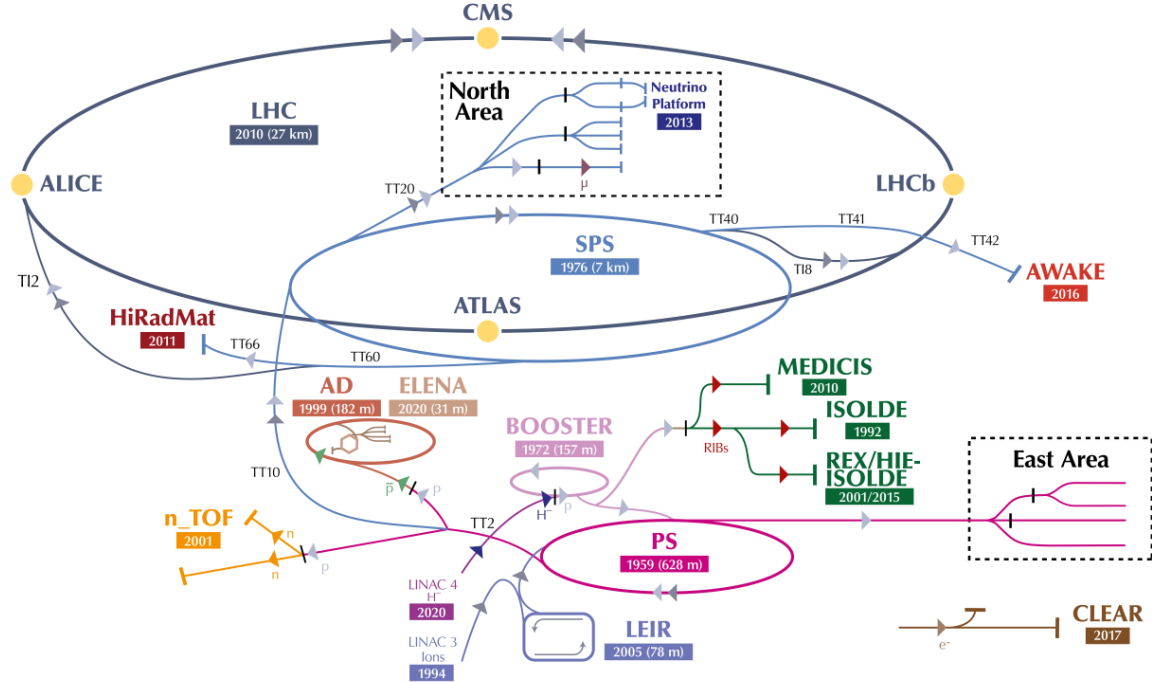
- Изучаване физичните закони от първия момент след Големият Взрив
- Симбиоза между Физика на елементарните частици, Астрофизика и Космология

# The Biggest Particle Accelerators Complex in the World



# The CERN accelerator complex

## Complexe des accélérateurs du CERN



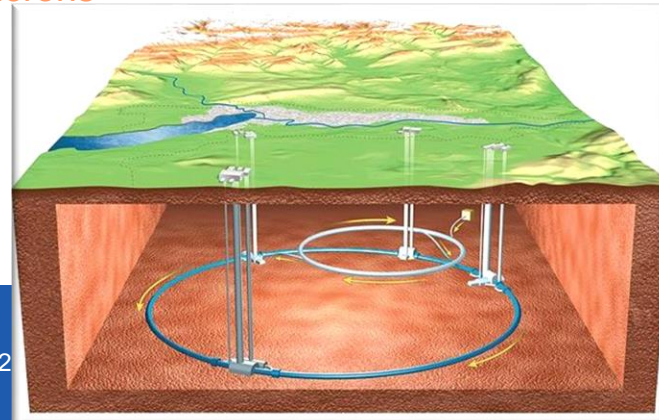
▶  $H^-$  (hydrogen anions) ▶ p (protons) ▶ ions ▶ RIBs (Radioactive Ion Beams) ▶ n (neutrons) ▶  $\bar{p}$  (antiprotons) ▶  $e^-$  (electrons) ▶  $\mu$  (muons)

LHC - Large Hadron Collider // SPS - Super Proton Synchrotron // PS - Proton Synchrotron // AD - Antiproton Decelerator // CLEAR - CERN Linear Electron Accelerator for Research // AWAKE - Advanced WAKEfield Experiment // ISOLDE - Isotope Separator OnLine // REX/HIE-ISOLDE - Radioactive Experiment/High Intensity and Energy ISOLDE // MEDICIS // LEIR - Low Energy Ion Ring // LINAC - LINear ACcelerator // n\_TOF - Neutrons Time Of Flight // HiRadMat - High-Radiation to Materials // Neutrino Platform



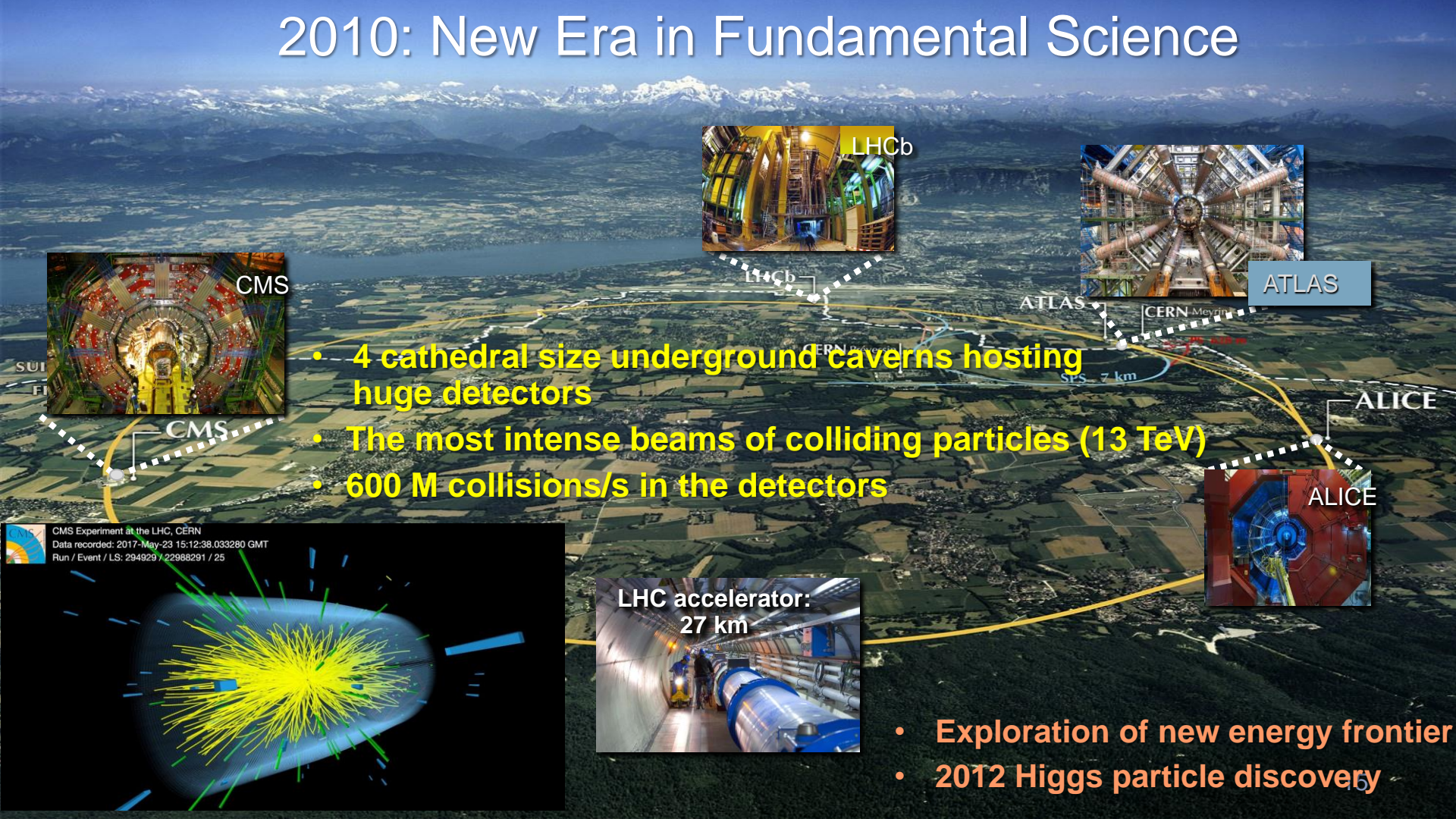
# The Large Hadron Collider

- The most powerful and complex instrument ever built to investigate particle properties
- 27km circumference, 100m underground
- The highest energy of any accelerator in the world
  - 6.5 TeV energy of the particle beams
- The coldest place in our galaxy - operating temperature 1.9 K (-271 C)
- The fastest 'track' on the planet
  - Particles travelling with 99.9999991% of the speed of light, circulating 11 245 times/s the 27 km tunnel
- Cross-section of the particle beam 16 microns
- ~10 000 magnets: 8.4 Tesla, ~12 kA
- Ultra-high vacuum ( $10^{-13}$  atm)





# 2010: New Era in Fundamental Science

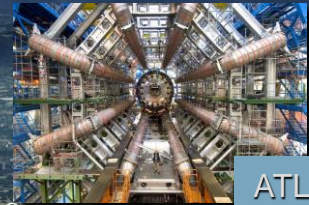


CMS

CMS

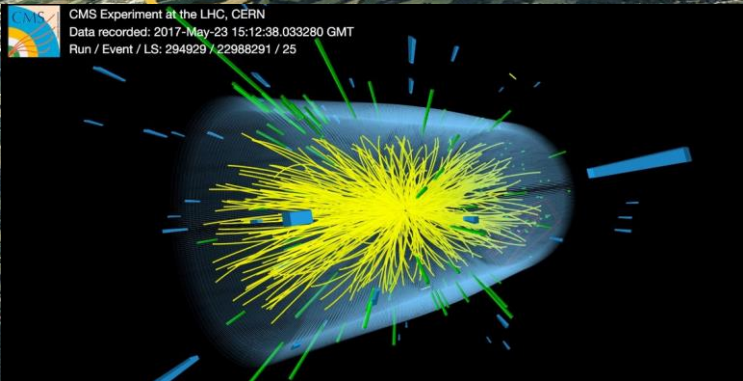


LHCb



ATLAS

- 4 cathedral size underground caverns hosting huge detectors
- The most intense beams of colliding particles (13 TeV)
- 600 M collisions/s in the detectors



CMS Experiment at the LHC, CERN  
Data recorded: 2017-May-23 15:12:38.033280 GMT  
Run / Event / LS: 294929 / 22988291 / 25



LHC accelerator:  
27 km



ALICE

- Exploration of new energy frontier
- 2012 Higgs particle discovery



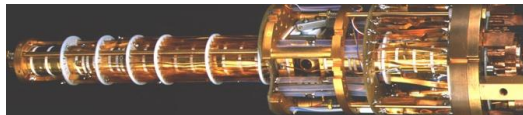
# Discovery 2012, Nobel Prize in Physics 2013

The Nobel Prize in Physics 2013 was awarded jointly to François Englert and Peter W. Higgs "for the theoretical discovery of a mechanism that contributes to our understanding of the origin of mass of subatomic particles, and which recently was confirmed through the discovery of the predicted fundamental particle, by the ATLAS and CMS experiments at CERN's Large Hadron Collider".

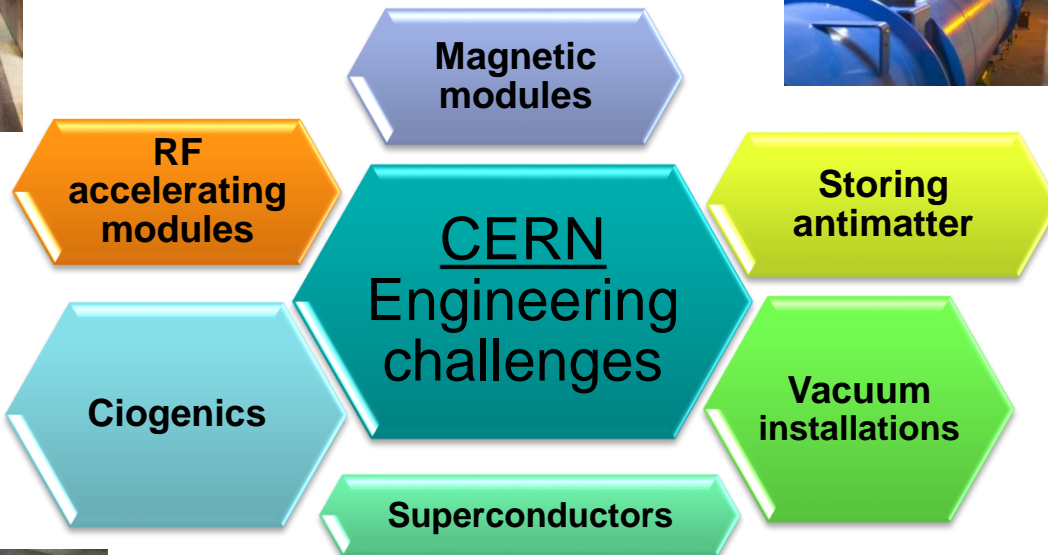




# CERN – Technologies Development and Innovations

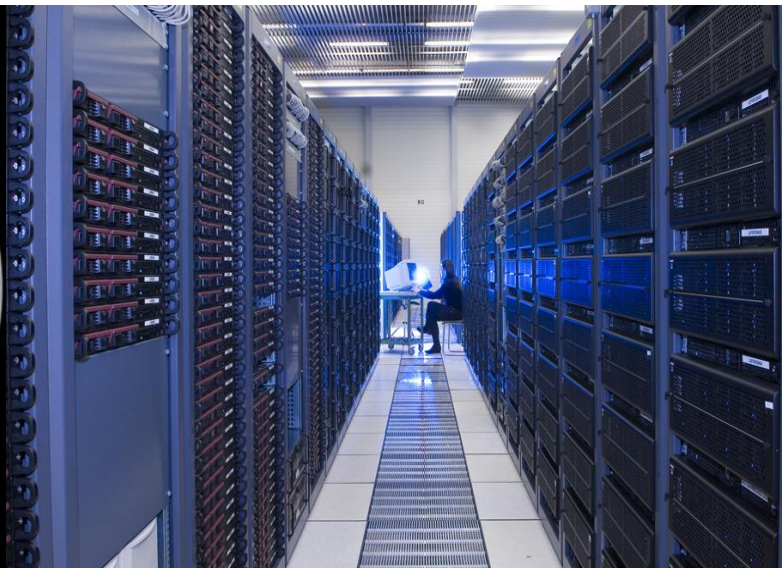
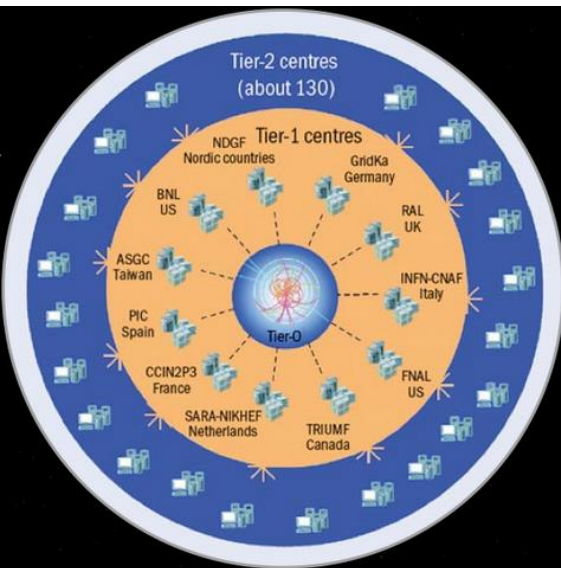


And a lot



and a lot more ...

# GRID Technologies for Analysing Data



- **170 institutes and universities**
- **40 countries**
- **500 PB data**
- **> 2million jobs processes /day**



# Bulgaria – Collaborator at CERN



- Long standing collaboration – started during the 1970s and 1980s.
  - ✓ Physics – collaboration started in 1975 – NA4 experiment and continued during the 1980s with LS3 experiment
    - Bulgarian Academy of Sciences, Institute for Nuclear Research and Nuclear Energy
    - Sofia University St. Kliment Ohridski, Faculty of Physics
  - ✓ Engineering fields – collaboration started in 1987 with the L3 experiment
    - Bulgarian Academy of Sciences, Institute of Robotics



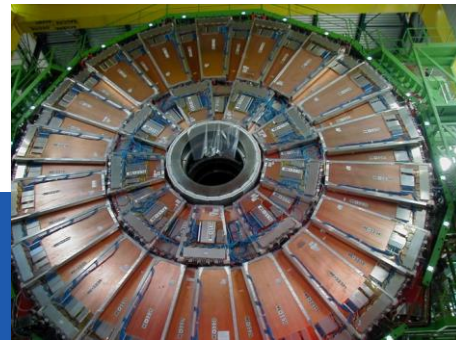
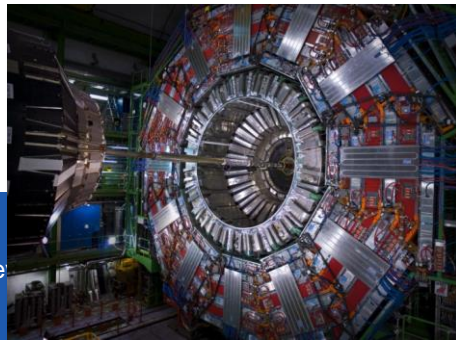
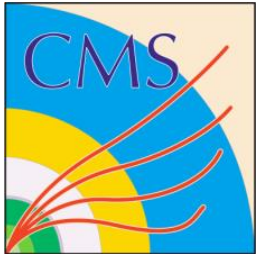




# Bulgaria – Collaborator at CERN



- The relationship has continued with the approval of the CMS experiment at the LHC where the main responsibility of Bulgarian physicists relied on the construction of the hadron calorimeter and of the RPCs for the barrel muon system.
- CMS collaboration:
  - Bulgarian Academy of Sciences, Institute for Nuclear Research and Nuclear Energy
  - Sofia University St. Kliment Ohridski, Faculty of Physics
  - Bulgarian Academy of Sciences, Institute of Robotics





- Bulgarian specialists have been very active in projects related to:  
LHC Computing Grid LCG, EGEE, SEEGRID
- Other experiments, where Bulgarian people contribute to are:
  - ATLAS
  - ALICE
  - NA49
  - NA61
  - NA62
  - ISOLDE



# Bulgarians at CERN



- The membership status of Bulgaria gives the possibilities to Bulgarian people to:
  - ✓ to work at CERN and contributes to CERN's activities
    - Members of personnel of CERN – physicist, engineers, software specialist, etc.
    - Participants in projects sent from their home institutes
  - ✓ To participate in education programmes



## 2023 statistics

- - Staff - 13
  - Fellows – 5
  - Associate members of personnel (project, cooperation associates) - 6
  - Technical students – 2
  - Doctoral students - 1
  - Users and visiting scientists - 73





# CERN – Education and Outreach Activities

## Scientists at CERN

Academic Training Programme



## Young researchers

- School of High Energy Physics
- School of Computing
- Accelerator School

## Students

Summer student programme (3m)  
Student programmes (6-12m)  
Internships

## Visitors

~150 000 /year

## Teachers programmes

International (2 weeks) & National (1 week)

## Bulgarian Teachers Programmes at CERN

Програми за ученици



# Education and Outreach Programs for Students

## Aim

- To spark the interest of students towards modern science, engineering disciplines and IT technologies

## How?

- To present the scientific research and engineering achievements in a way, which is accessible and interesting to the students  
=> To present what CERN does

## Why?

- Become more inquisitive, curious, interested in science, improve their school performance and some of them can continue their education in the STEM area.



## CERN Bulgarian programs – example of collaboration and participation from

- Schools
- Universities
- Research centres



# Bulgarian Education Outreach Activities related to CERN

- Overview of major milestones during the last 15 years

**Bulgarian National  
Physics Teachers  
Program**  
2008

First **Video Conferences  
and Virtual Visits**  
2013

**Bulgarian  
High School Students  
Internship Program**  
2017

First **Physics Masterclasses &  
other IPPOG activities**  
2018

2023  
Back to “normal”  
operation mode 😊

2010  
First **High School Students  
Visits@CERN**

2014  
**Bulgarian National  
Engineering and IT Teachers  
Program**

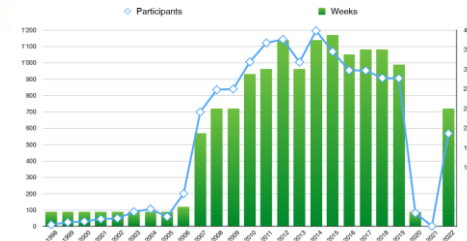
2017  
**BeamLine4 School**  
First Bulgarian students  
team participated

2020-2022  
**On-line  
Physics Masterclasses  
& Lectures**





# Teacher Programme Participants 1998-2022 (Total: 13 871)



## Member States 11 056

Austria 300 – Belgium 144 – Bulgaria 821  
Czech Republic 171 – Denmark 348 – Finland 550  
France 465 – Germany 1142 – Greece 952  
Hungary 561 – Israel 56 – Italy 1139  
Netherlands 227 – Norway 158 – Poland 588  
Portugal 495 – Romania 20 – Serbia 84  
Slovakia 307 – Spain 705 – Sweden 311  
Switzerland 135 – United Kingdom 1372

## Associate Member States

### in the pre-stage to Membership 165

Cyprus 16 – Estonia 105 – Slovenia 44

## Associate Member States 889

Croatia 114 – India 15 – Latvia 76 – Lithuania 64  
Pakistan 9 – Türkiye 403 – Ukraine 208

## Observers 579

Japan 12 – Russia (suspended) 431  
United States of America 136

## Non-Member States and Territories 1182

Algeria 11 – Angola 11 – Argentina 3 – Armenia 3 – Australia 14 – Azerbaijan 2 – Bahrain 3 – Bangladesh 1 – Belarus 11  
Bosnia & Herzegovina 36 – Brazil 273 – Burundi 2 – Cameroon 11 – Canada 20 – Cape Verde 5 – Chile 4 – Colombia 8  
Costa Rica 4 – Dominican Republic 73 – Ecuador 2 – Egypt 3 – Eswatini 1 – Georgia 194 – Ghana 7 – Guinea Bissau 2  
Indonesia 3 – Iran 15 – Ireland 10 – Jordan 13 – Kazakhstan 14 – Kenya 4 – Kuwait 1 – Kyrgyzstan 1 – Lebanon 21  
Madagascar 2 – Malaysia 3 – Malta 51 – Mexico 113 – Moldova 4 – Mongolia 1 – Montenegro 17 – Morocco 2  
Mozambique 24 – Nepal 6 – New Zealand 5 – Nigeria 2 – North Macedonia 13 – Palestinian Territories 5  
People's Republic of China 3 – Philippines 2 – Qatar 1 – Republic of Korea 49 – Rwanda 20 – Sao Tome 8  
Saudi Arabia 1 – Singapore 2 – South Africa 9 – Sri Lanka 3 – Taiwan 1 – Tajikistan 1 – Tanzania 1 – Thailand 23  
Timor-Leste 10 – Uganda 3 – United Arab Emirates 1 – Uruguay 3 – Venezuela 1 – Vietnam 2 – Zimbabwe 1

# Bulgarian National High School Teachers Programmes

- Part of the National Programs for High School Teachers at CERN
  - CERN's web-site: <http://teacher-programmes.web.cern.ch/ntp/bulgaria>
- Teachers from secondary schools: students age - 14 to 19 years old
- In total **821 participants** (teachers) visited CERN during the period: 2008 – 2022
- **Physics Teachers program** – 13 editions, launched in **2008**
  - Each program is over a 5-day period, delivered in Bulgarian and includes 4 modules
    - ✓ Lectures and discussions with Bulgarian scientists, engineers and IT specialists
    - ✓ Visits of CERN sites and facilities, e.g. CMS, ATLAS, SM18, CERN Control Centre, Linac2, Lear, IT Data Centre, etc.
    - ✓ Visits of CERN Exhibitions: Microcosm and Globe - Universe of Particles
    - ✓ Usage of CERN's S'Cool Lab facility for hands-on experiments, e.g. Building a Cloud Chamber



# Bulgarian National High School Teachers Programmes

- The programs are organized together with the Education, Communications and Outreach Group
  - ⇒ Special thanks to **Jeff Wiener** (IR-ECO) – Teacher Program Manager
- Bulgarian coordinators of the **Physics Teachers program**:
  - Prof Vladimir Genchev (Bulgarian Academy of Sciences, Institute for Nuclear Physics and Nuclear Energy) - period: 2008 - 2013
  - Assoc. Prof Plamen Iaydjiev (Bulgarian Academy of Sciences, Institute for Nuclear Physics and Nuclear Energy) period: 2014 – 2022
  - Dr Roumyana Hadjiiska (Bulgarian Academy of Sciences, Institute for Nuclear Physics and Nuclear Energy) since 2023
  - Svejina Dimitrova (Bulgarian National Observatory and Planetarium Varna) since 2008
  - Zornitsa Zaharieva (CERN) since 2008
- In 2010 a **one-off, special 3-day program for directors for Mathematics and Natural Sciences Schools** was organized, which led to the **involvement of the Bulgarian Ministry of Education and Science**
- Since 2011 the programs are **officially supported by the Bulgarian Ministry of Education and Science**, which runs the selection process for the teachers and pays for their trip and stay at CERN
  - Recognized as **official qualification programs** for the teachers





# *Bulgarian National High School Teachers Programmes*

- **Engineering and IT Teachers program** – 7 editions, launched in 2014
- Warmly welcomed in 2014 by the Education Group at CERN and CERN's Director General Rolf Heuer as it was the first CERN program targeting engineering and IT teachers
- It is based on the format of the Physics Teachers programs, but focuses more on the engineering and IT achievements at CERN with specific lectures for those
- Bulgarian coordinators of the program:
  - Prof Roman Zahariev (Bulgarian Academy of Sciences, Institute of Robotics)
  - Svejina Dimitrova (Bulgarian National Observatory and Planetarium Varna)
  - Zornitsa Zaharieva (CERN)



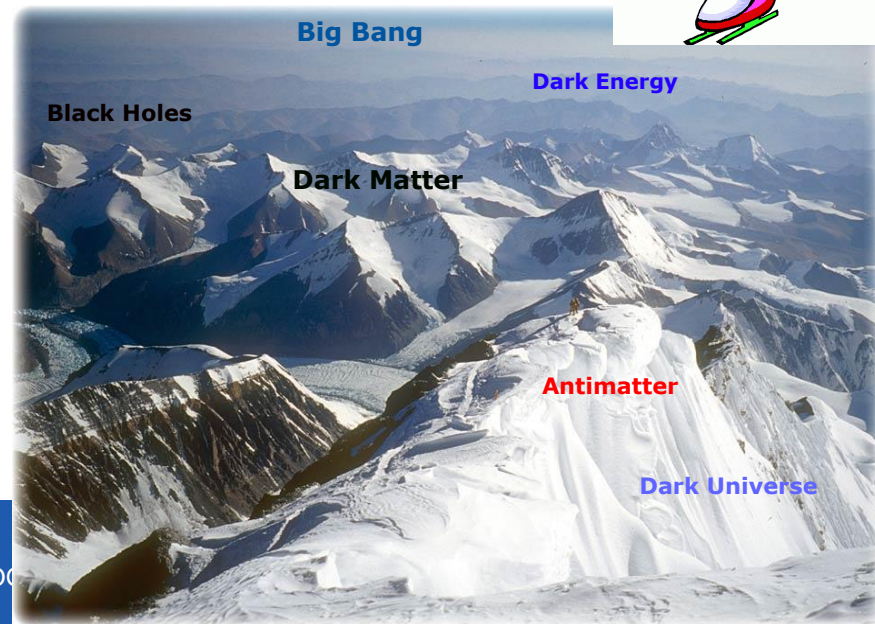
# To take the students on a visit to enjoy the beautiful views...

*“The whole art of teaching is only the art of awakening the natural curiosity of young minds for the purpose of satisfying it afterwards.”*

*Anatole France*

*“Изкуството да се преподава е всъщност изкуството да се разпали любознателността на младите и тя да се задоволи след това.”*

*Анатол Франс*



# Bulgarian High School Students Visits @ CERN

- First groups of High School students visited CERN in 2010
- CERN Bulletin: “150 Bulgarian students visit CERN” (Issue No. 21-22/2010)
- ~ 4 150 high school students from all over Bulgaria have visited CERN during the period 2010 – 2023
- Between 10 and 14 groups of students visit CERN every year
  - ✓ Students from all over Bulgaria – Varna, Sofia, Plovdiv, Veliko Turnovo, Blagoevgrad, Burgas, Beloslav, Razgrad, Stara Zagora, etc.
  - ✓ Visits concentrated during the various school holidays – April, May, July



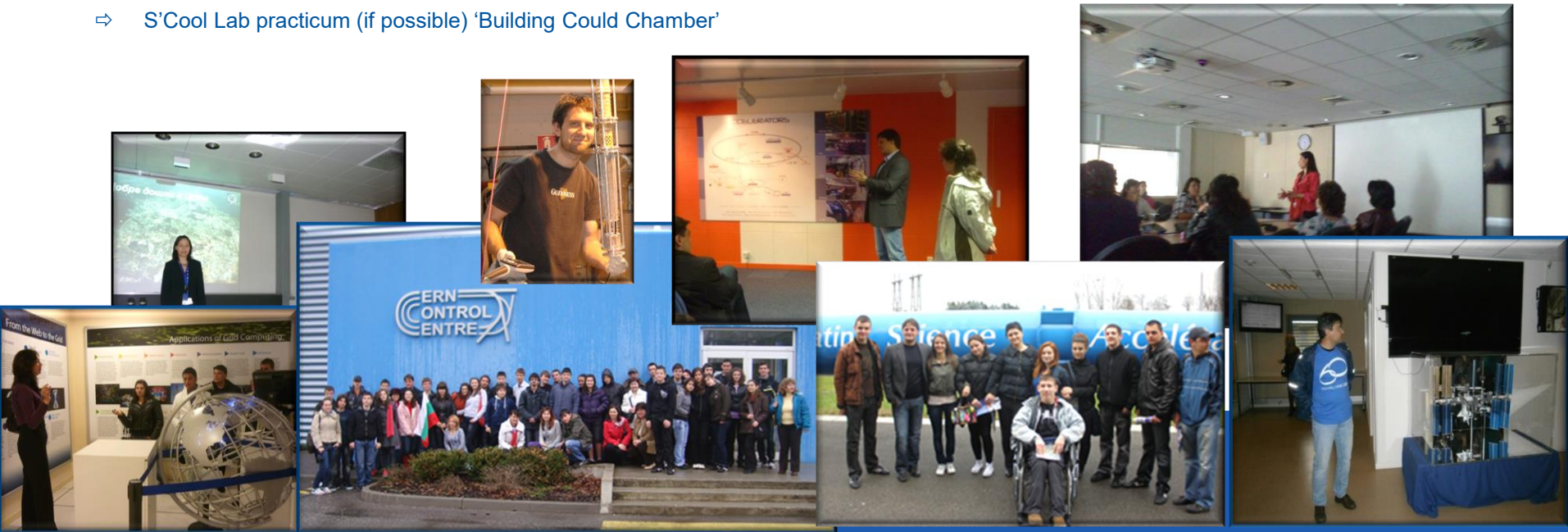
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# Bulgarian High School Students Visits @ CERN

- Considered extremely **important part of the Bulgarian Outreach activities** - supported by the whole Bulgarian community at CERN
- A program of 1 day is prepared and guided for each group by the Bulgarian community at CERN
- The programs consists of:
  - ⇒ 0.5 days standard CERN visit
  - ⇒ Additional lectures, visits of CERN sites, discussions with Bulgarian scientists and engineers
  - ⇒ Visits of CERN's exhibitions – MicroCosm, Universe of Particles
  - ⇒ S'Cool Lab practicum (if possible) 'Building Could Chamber'



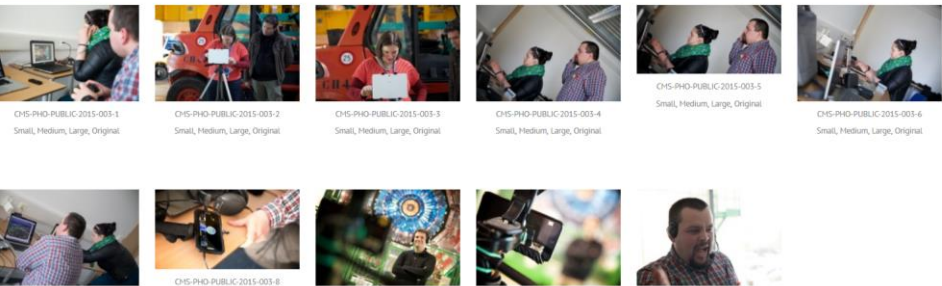
# Video Conferences and Virtual Visits

- Video Conferences started in **2013**
- Virtual Visits launched in **2014**
- **12 events** organized for the period 2013-2022, reaching **44 schools** from **23 towns** in Bulgaria
- Organized and supported by the Bulgarian community at CERN

**CMS Virtual Visit from Bulgaria**

Conditions of Use © 2015 CERN, for the benefit of the CMS Collaboration

View as Slideshow



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Small, Medium, Large, Original

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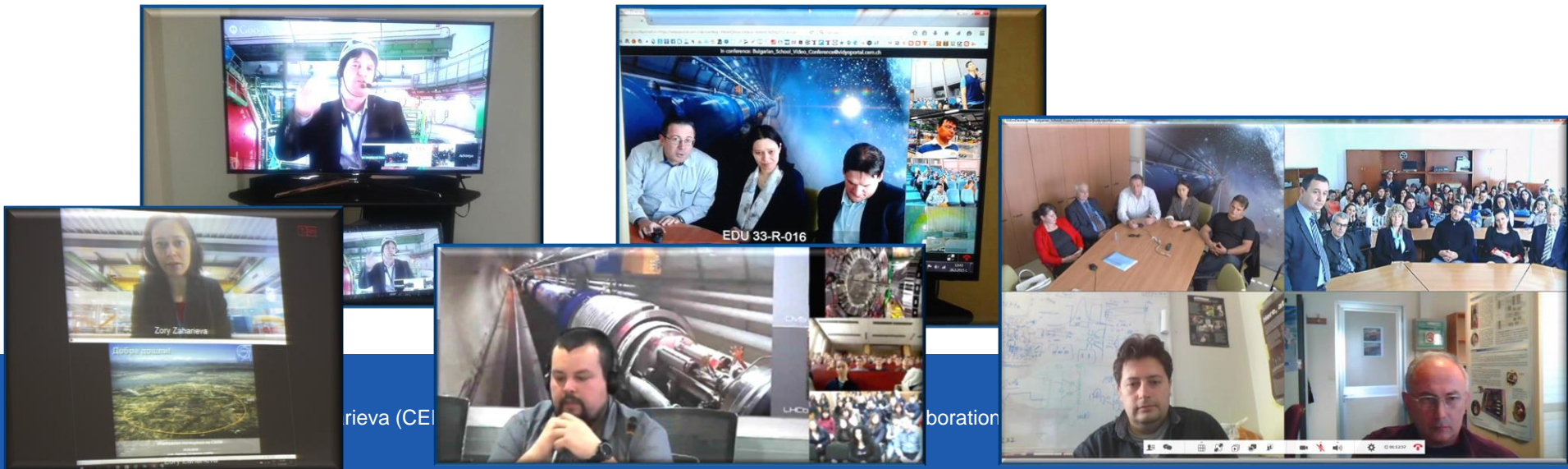
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# Video Conferences and Virtual Visits

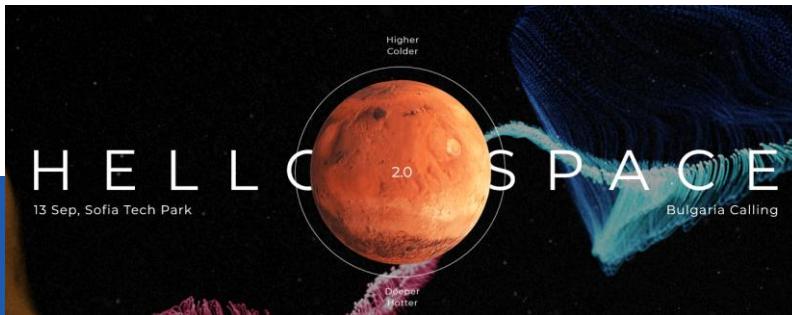
- Very high level of interest and participation in each event
- **Example:** December 2016
  - 18 schools simultaneously from all over the country participated
  - ~1 000 students reached during the event
  - During 3-hour period several CERN sites were visited, e.g. CMS detector, LHC tunnel, SM18 by 6 Bulgarian guides
  - Q&A session with the students was held in dedicated virtual rooms after the visits with the help of 20 Bulgarian scientists and engineers





# Virtual Tour of CERN for the Sofia Science STEAM Festival

- Hello Space, Bulgaria Calling – Science STEAM Festival, 13 Sep 2022
  - 2-hour programme for the live connection with the annual Science Festival in Sofia
  - Audience – mainly school students and their teachers – expressed high level of satisfaction with the event
  - The virtual tour was watched by ~1000 people in Sofia Tech Park and ~ 2000 people on-line
  - The main national Bulgarian TV channels broadcasting news reports about the event with ~1 million viewers reached by the TV channels.
  - With the communication campaign of the festival, it is estimated that they reached 4,853,210 people through various media channels (radio, tv, social media, on-line platforms, etc.).
- Preparing the virtual tour of CERN for the next edition of the festival – 29 Jun 2023



# Bulgarian High School Students Internship Programme



✓ A pilot programme – 3 – 17 Sep 2017 (<https://indico.cern.ch/e/BGHSSIP17>)

- Very competitive selection – 324 applicants
- The selection criteria were developed taking into account the specificities of the Bulgarian education system
- Participants – 24 students from 11 towns & cities
- Extremely **intensive and content-rich programme**

✓ **Highly successful program** – popularizing education in STEM and establishing networks

- Students projects presentations back at school and at conferences
- First experience in writing scientific articles (4 students)
- Interviews to newspapers, radio, TV stations

➤ Looking to find ways to continue the programme

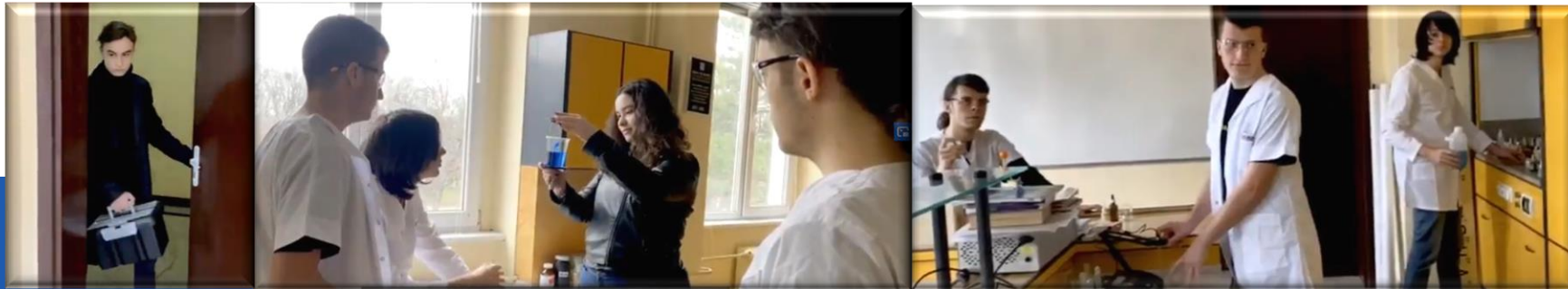


Zornitsa Zharanova (CERN)



# Participation in International Competitions

- Beamline for Schools competition (<http://cern.ch/bl4s>)
  - A team competition for students from all over the world
  - 2017 - for the first time a Bulgarian team from the Mathematics school in Vratsa participated with full support of Dr. Venelin Kozhuharov (Physics Faculty in Sofia University St. Kliment Ohridski)
  - In 2018 - 2 teams participating:
    - The team from the Mathematics school in Vratsa
    - A team from the Language school in Burgas with the support of Dr. Milena Misheva (Bulgarian Academy of Sciences, INRNE)
  - In 2020 the Bulgarian team “Crystal” from Shumen - teacher Aneta Marinova from Shumen
    - with the support of Dr. Roumyana Hadjiiska (Bulgarian Academy of Sciences, INRNE),
    - ✓ received special distinction from the competition – T-shirts and Cosmic Pi detector





# International Physics Masterclasses – start 2018



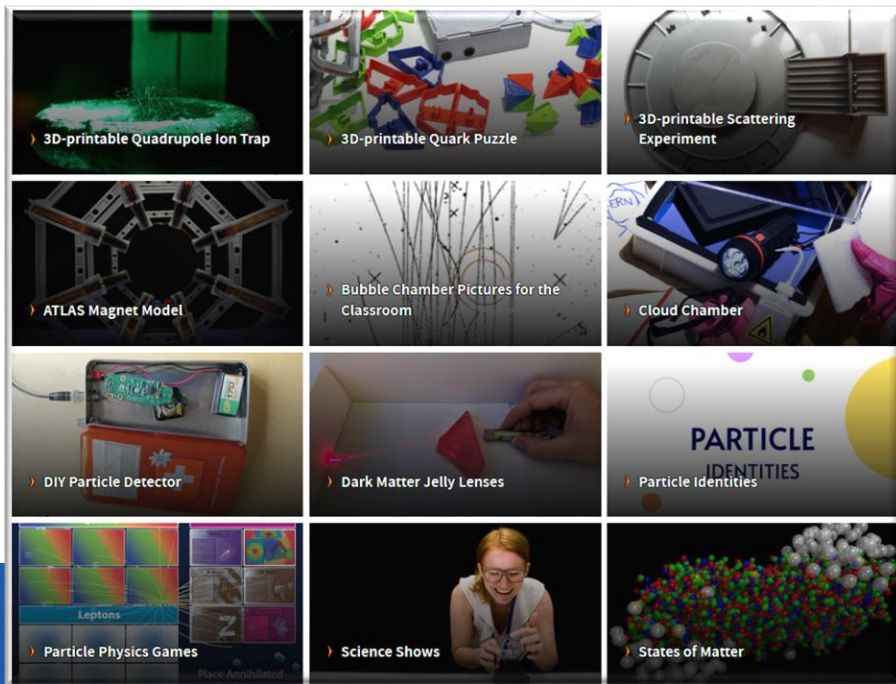
- Part of the International Particle Physics Outreach Group (IPPOG) activities
- CERN CMS Masterclass in Bulgaria with the support of the Open Schools for Open Societies (OSOS) project (<https://www.openschools.eu/>)
- Main organizers:
  - ✓ Bulgarian Academy of Sciences, Institute of Nuclear Research and Nuclear Energy: *Roumyana Hadjiiska, Boyka Aneva, Plamen Iaydjiev, Mariana Shopova*
  - ✓ University of Sofia, Faculty of Physics: *Leandar Litov, Borislav Pavlov, Venelin Kozhuharov, Mark Marinov, Milena Misheva, Elton Shumka, Galina Vankova-Kirilova*
  - ✓ National Observatory and Planetarium Varna: *Svejina Dimitrova*
  - ✓ CERN: *Zornitsa Zaharieva*
  - ✓ *Sofia Tech Park*
- 1 full day event (<https://indico.cern.ch/event/1245208/>):
  - ✓ Morning block of lectures
  - ✓ Afternoon block of practical exercises on CMS data
  - Video conference with CERN at the end of the day
- 2023 participants ~ 150 students coming from all over Bulgaria





# Virtual Events and On-line Resources

- Interactive on-line Science Shows
- Materials published to work at home/school: <https://scoollab.web.cern.ch/classroom-activities>
- Educational materials: <http://home.cern/students-educators>





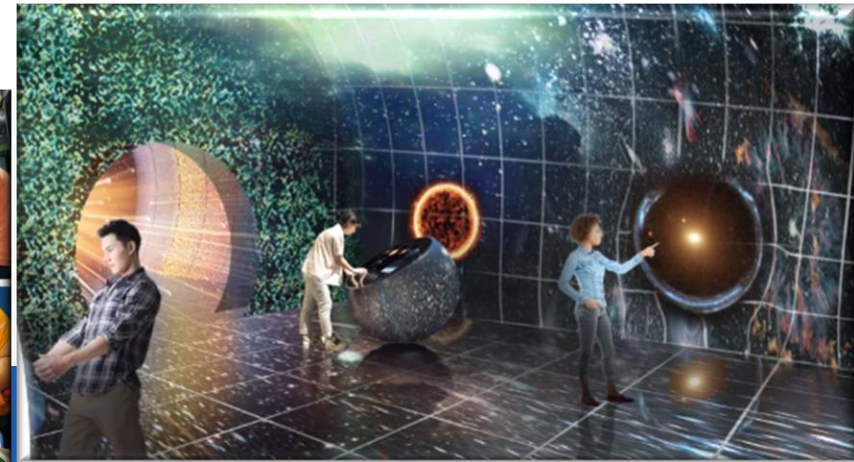
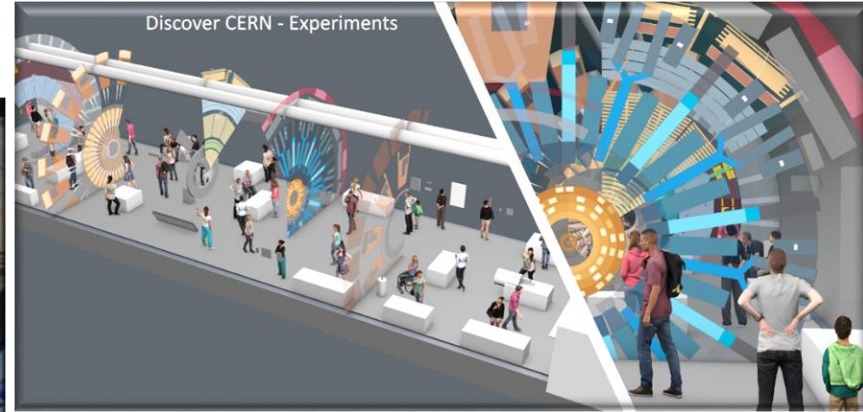
# Science Gateway – New Iconic Facility for Science

- Education and Outreach facility
- Inspire students to aim for STEM careers
- Outreach to general public and contribute to positive perception towards science and fundamental research
- Public – ages 5 to 105+
- World-renowned architect Renzo Piano
- Public opening in October 2023



# Science Gateway Exhibitions and Events

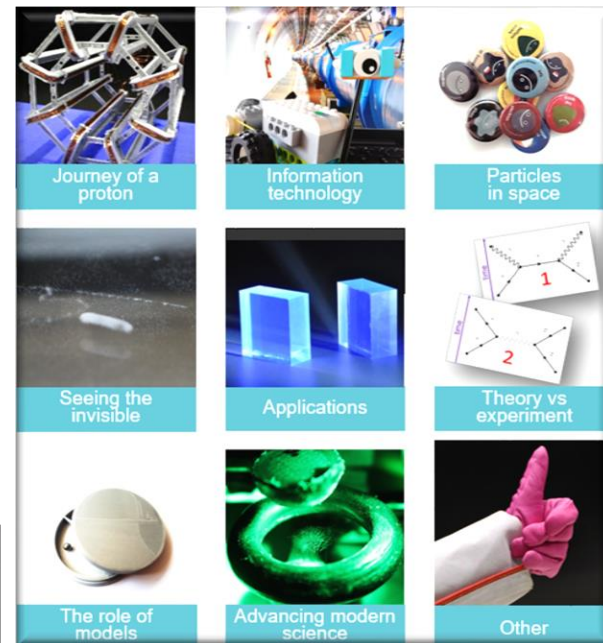
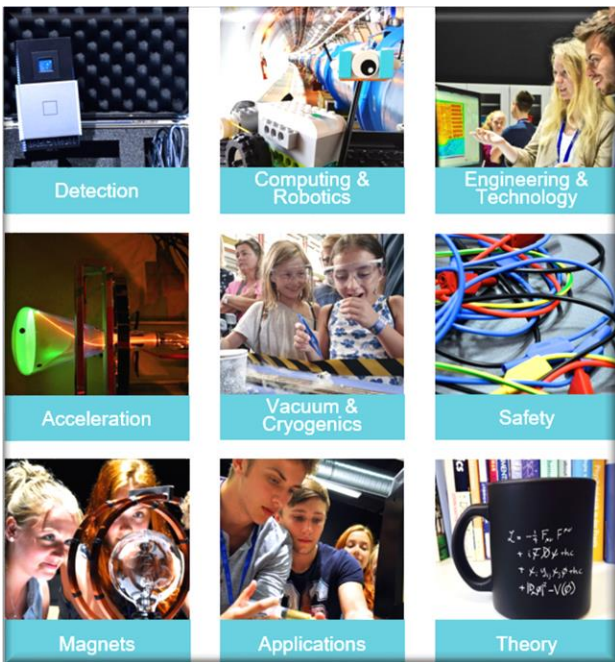
- 3 exhibition buildings 1300m<sup>2</sup>
  - Discover CERN
  - Our Universe
  - Quantum World
- Events and lectures





# Science Gateway

- Education Labs



- Science Shows



# CERN STEM Education Outreach Activities related to Bulgaria

- ⇒ **Started in 2008** with the Physics Teachers program, expanded with the School Visits in 2010 and naturally progressed with various other activities during the past 15 years
  - ↳ Continuously evolving and enriching
  - ↳ Virtual tours and video conferences started in 2013
- ⇒ All activities had a **huge impact on the students and the teachers** - popularizing modern science, building networks in schools, inspiring young minds
- ⇒ There has been a big impact on the general public through **mass-media outreach**, triggered by those activities
- ⇒ Virtual offerings - big advancement due to Covid-19 impact
  - ⇒ Physics Masterclasses, lectures on-line in 2021, etc.

**“The good teacher explains. The superior teacher demonstrates. The great teacher inspires”**

**William Ward**

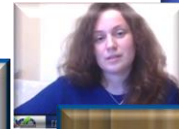


# CERN STEM Education Outreach Activities related to Bulgaria

⇒ The success of the Bulgarian outreach activities is due to the **excellent collaboration, great enthusiasm and support** from:

- ✓ The whole Bulgarian community at CERN
- ✓ All collaborators from Bulgarian institutes and universities and mainly:
  - Sofia University St Kliment Ohridski – Faculty of Physics,
  - Bulgarian Academy of Sciences - Institute of Nuclear Physics and
  - Bulgarian Academy of Sciences - Institute of Robotics
- ✓ The National Astronomical Observatory and Planetarium – Varna
- ✓ Sofia Tech Park
- ✓ The Education and Outreach Group at CERN
- ✓ The Bulgarian Ministry of Education and Science

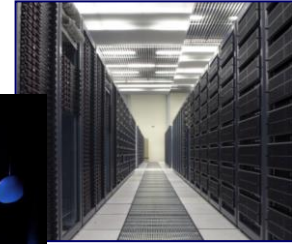
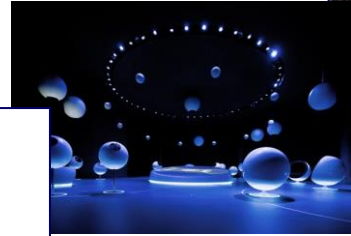
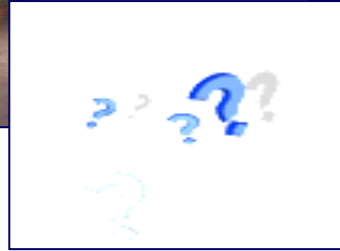
➤ **Great team work!**



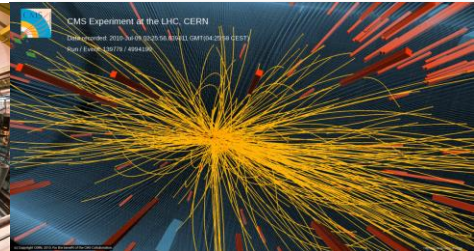
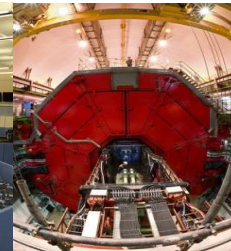
# Thank you for your attention!

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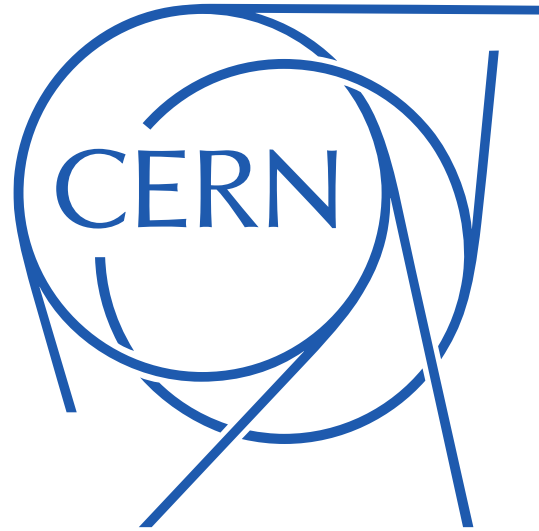
## Questions ?



*Zornitsa.Zaharieva @cern.ch*







# Impact from the Teachers programs on the teachers

- Further development of the teachers' qualifications
- Building professional networks amongst the teachers for exchange of best teaching practices (keeping in touch via Facebook groups, which are per program and per year as well as there is a common one for all teachers programs)
- Each one of the 759 teachers presented CERN and their experience to their colleagues in the schools
- Participation with CERN-based content and developments in the national competitions for lessons development , e.g. 'Physics in my eyes' as well as national conferences in Physics
- Participation and organization of conferences & workshops 'CERN for science and society'
- 3 editions of the National Conference "Europe – Territory of Knowledge"



# ***Impact and direct results from the Teachers and Students programs***

- The teachers become the **ambassadors of the modern science at school** by:
  - ✓ **Enriching the school curriculum** with the latest achievements in physics, engineering, IT
    - ⇒ All teachers who came to CERN contributed to **mapping the Bulgarian school curriculum and lessons to the specific lectures and materials from the Teachers programs at CERN**
  - ✓ Motivating the students to be more proactive during the classes in natural sciences, engineering and IT
  - ✓ Organized more than **75 exhibitions** dedicated to CERN in schools across Bulgaria





# ***Impact and direct results from the Teachers and Students programs***

- The students and teachers become the **ambassadors of the modern science at schools** by organizing numerous:
  - ✓ Science quizzes
  - ✓ Presentations from teachers to students or from students to students
  - ✓ Poster sessions



# Impact and direct results from the Teachers and Students programs

- The students and teachers become the **ambassadors of the modern science at schools**:
  - ✓ Delivering/creating
    - ✓ Models and mock-ups for their schools
    - ✓ Participating in many national competitions, e.g. “Cosmos – present and future of the mankind”, etc.





# Impact and direct results from the Teachers and Students programs

- The teachers become the ambassadors of the modern science at school together with their students:
  - ✓ 58 clubs 'Friends of CERN' created in various schools in Bulgaria
  - ✓ Motivating the students to continue their university education in the fields of natural sciences, engineering and IT

*"The good teacher explains. The superior teacher demonstrates. The great teacher inspires"*

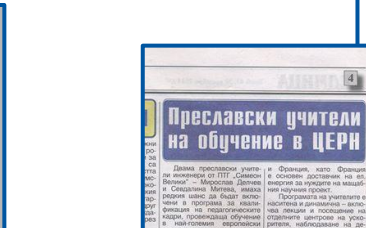
William Ward





# Impact and direct results from the Teachers and Students programs

- General Public Outreach
  - More than **400 national and regional newspapers publications** – triggered by interviews with the participants of the programs
  - Interviews for **local and national TV channels and radio stations**
  - Press conferences



# Impact and direct results from the Teachers and Students programs

- General Public Outreach
  - Since 2014 every year a journalist from the AzBuki publishing house accompanies the teachers programs with the support from the Bulgarian Ministry of Education and Science
  - Several articles are published in the Bulgarian Ministry of Education and Science newspaper "AzBuki" every year

