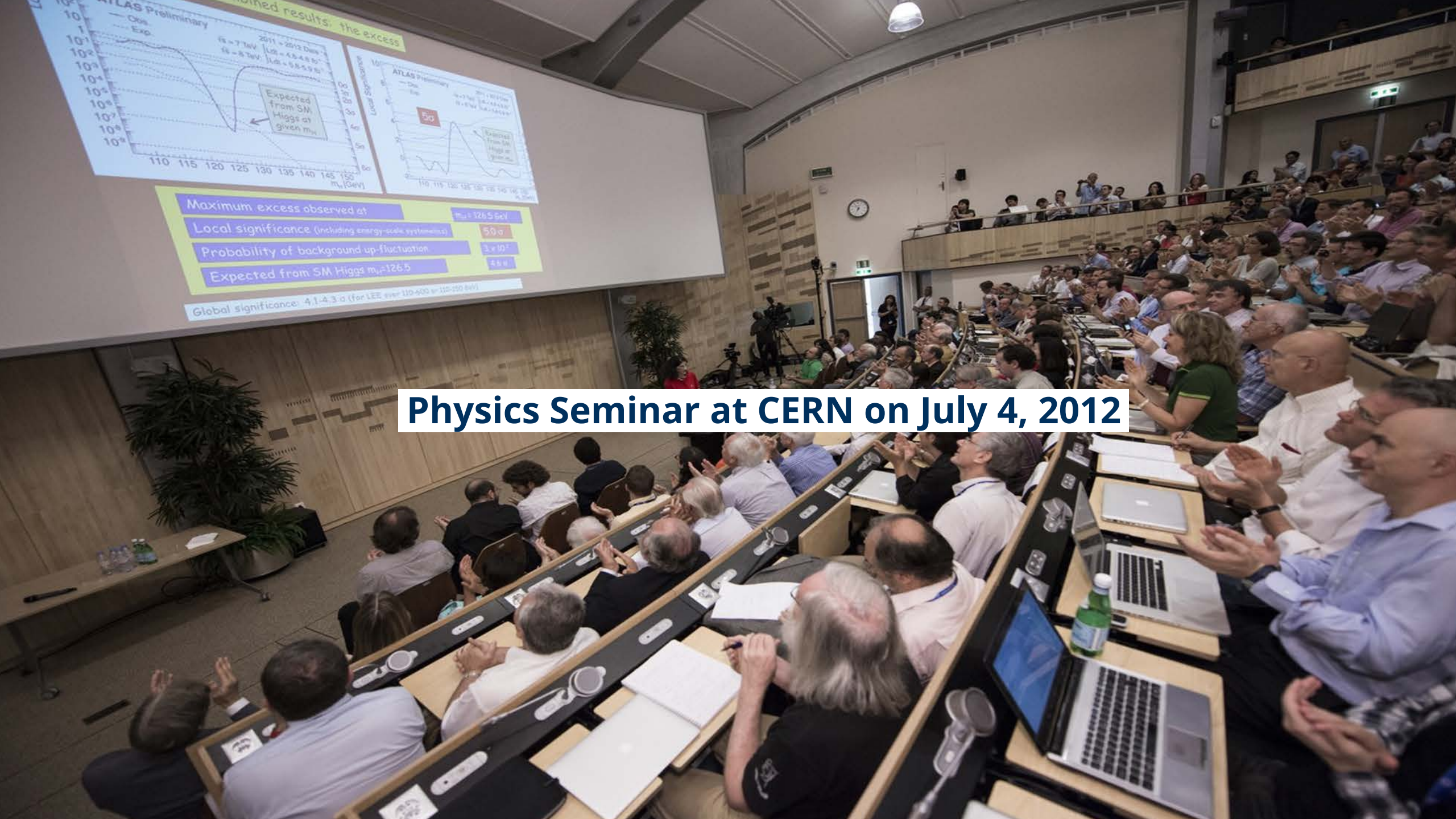
Uta Bilow, TU Dresden

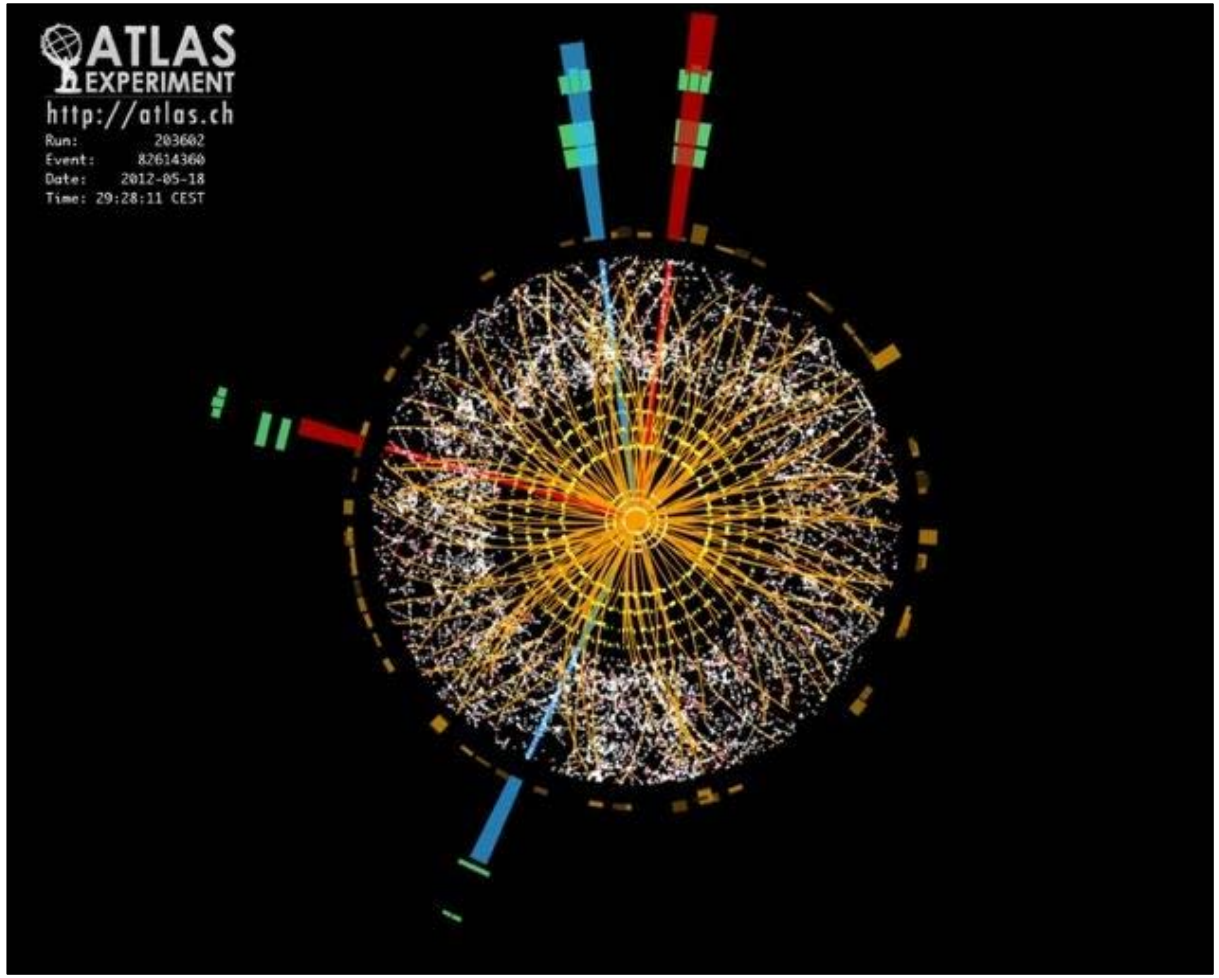
Outreach: why and how?

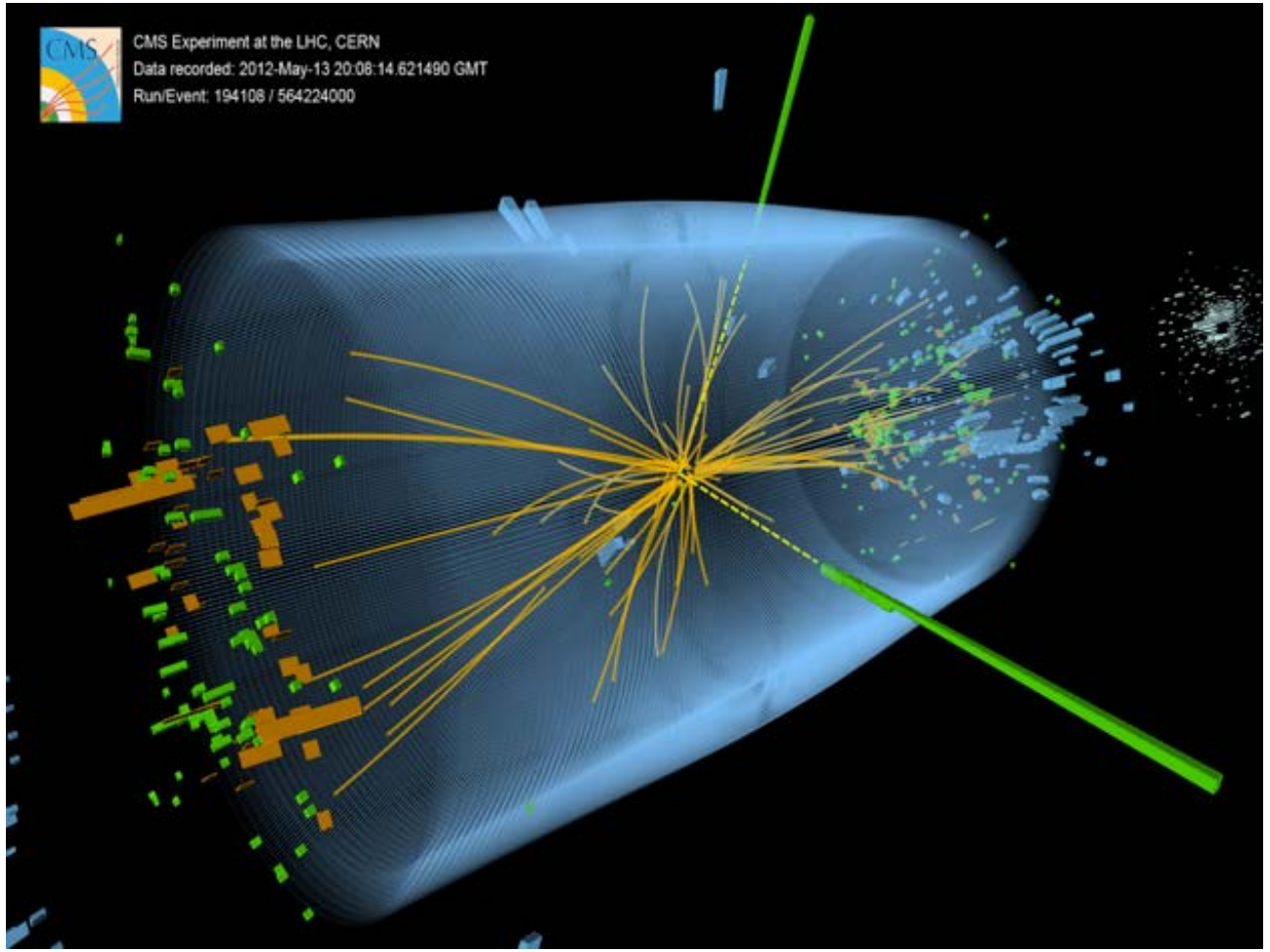
Introduction to the Terascale School I March 11, 2023



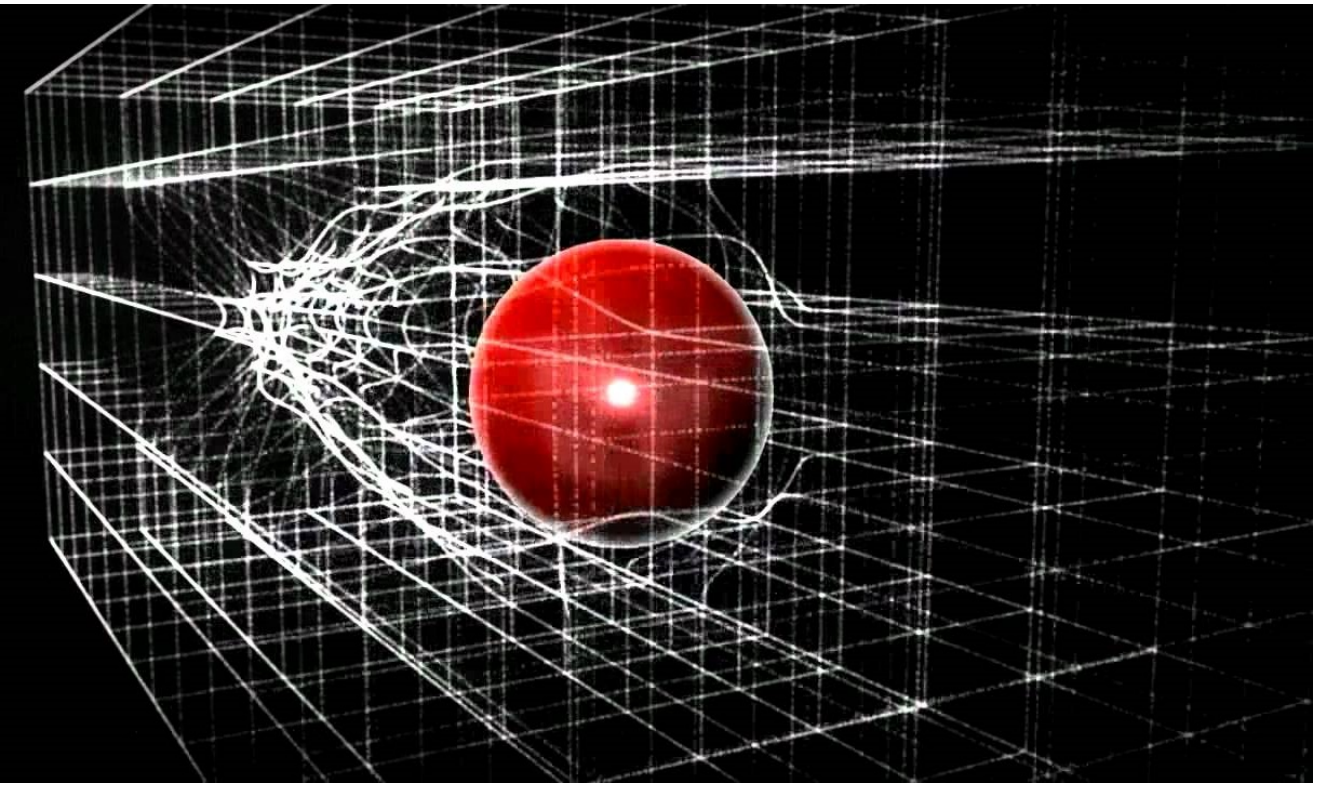
Physics Seminar at CERN on July 4, 2012

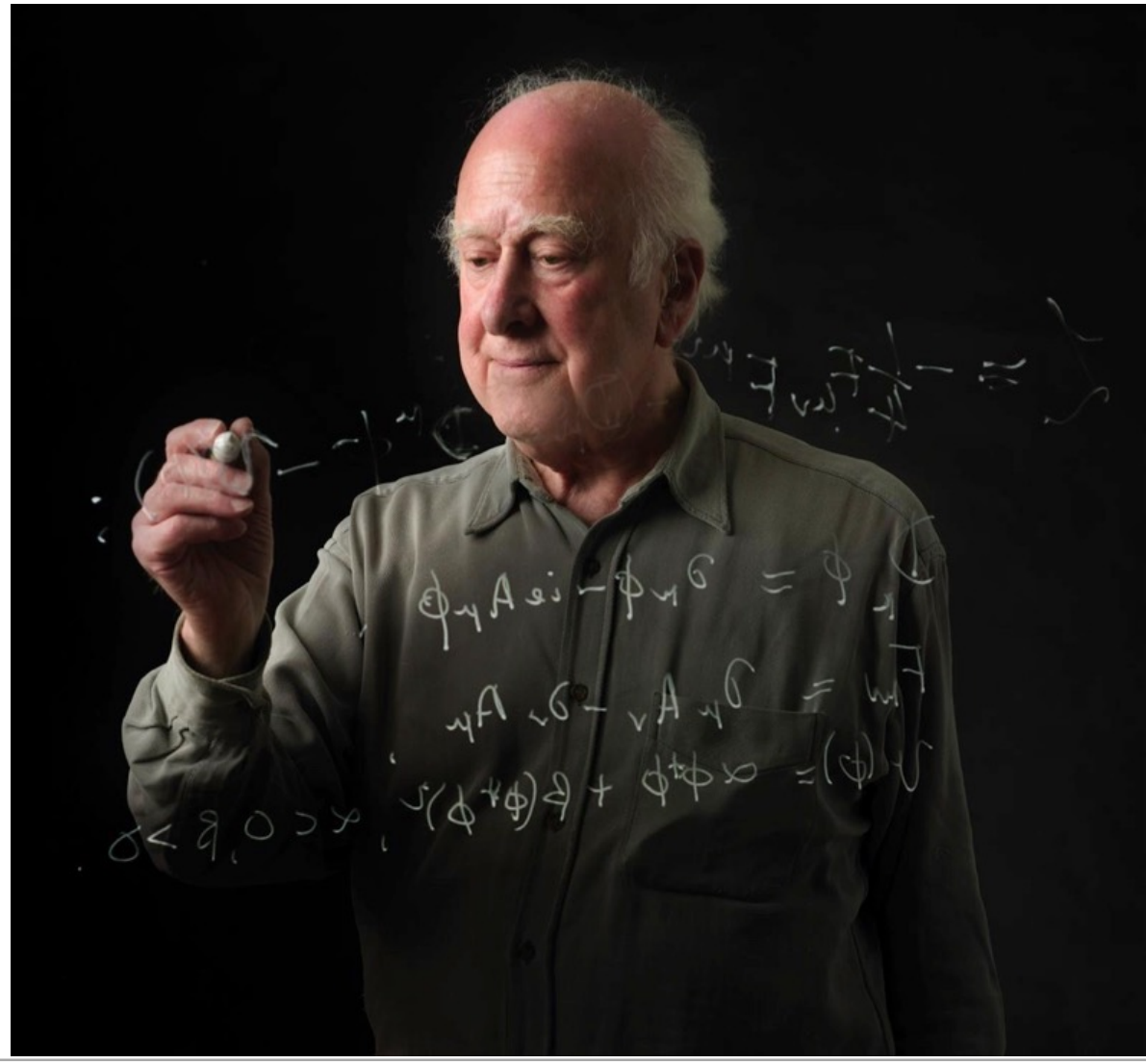
Higgs events

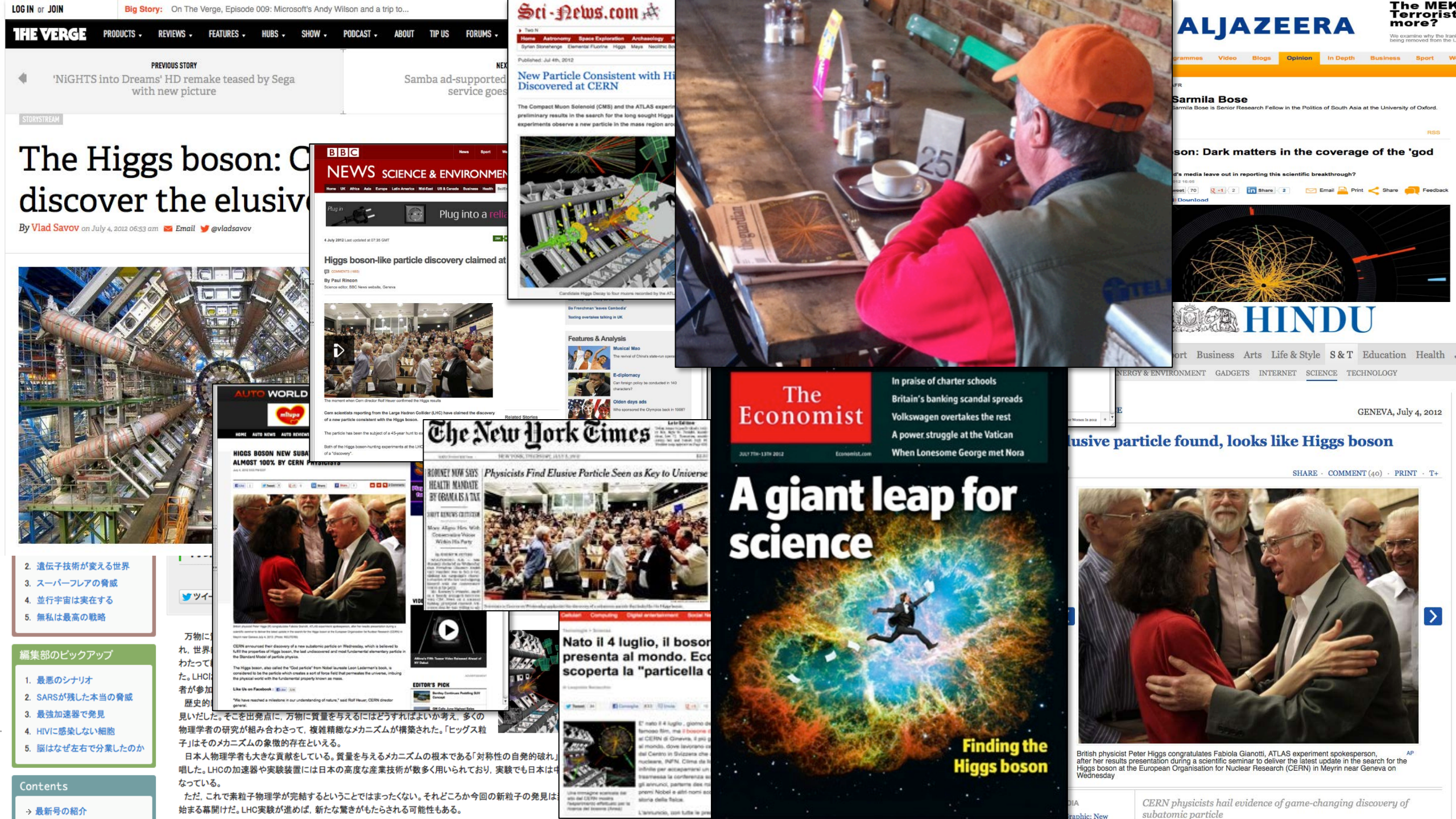




How do elementary particles attain mass? (Proposed in 1964)



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Sarmila Bose
Sarmila Bose is Senior Research Fellow in the Politics of South Asia at the University of Oxford.
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The New York Times
Physicists Find Elusive Particle Seen as Key to Universe
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A giant leap for science
Finding the Higgs boson
GENEVA, July 4, 2012
usive particle found, looks like Higgs boson
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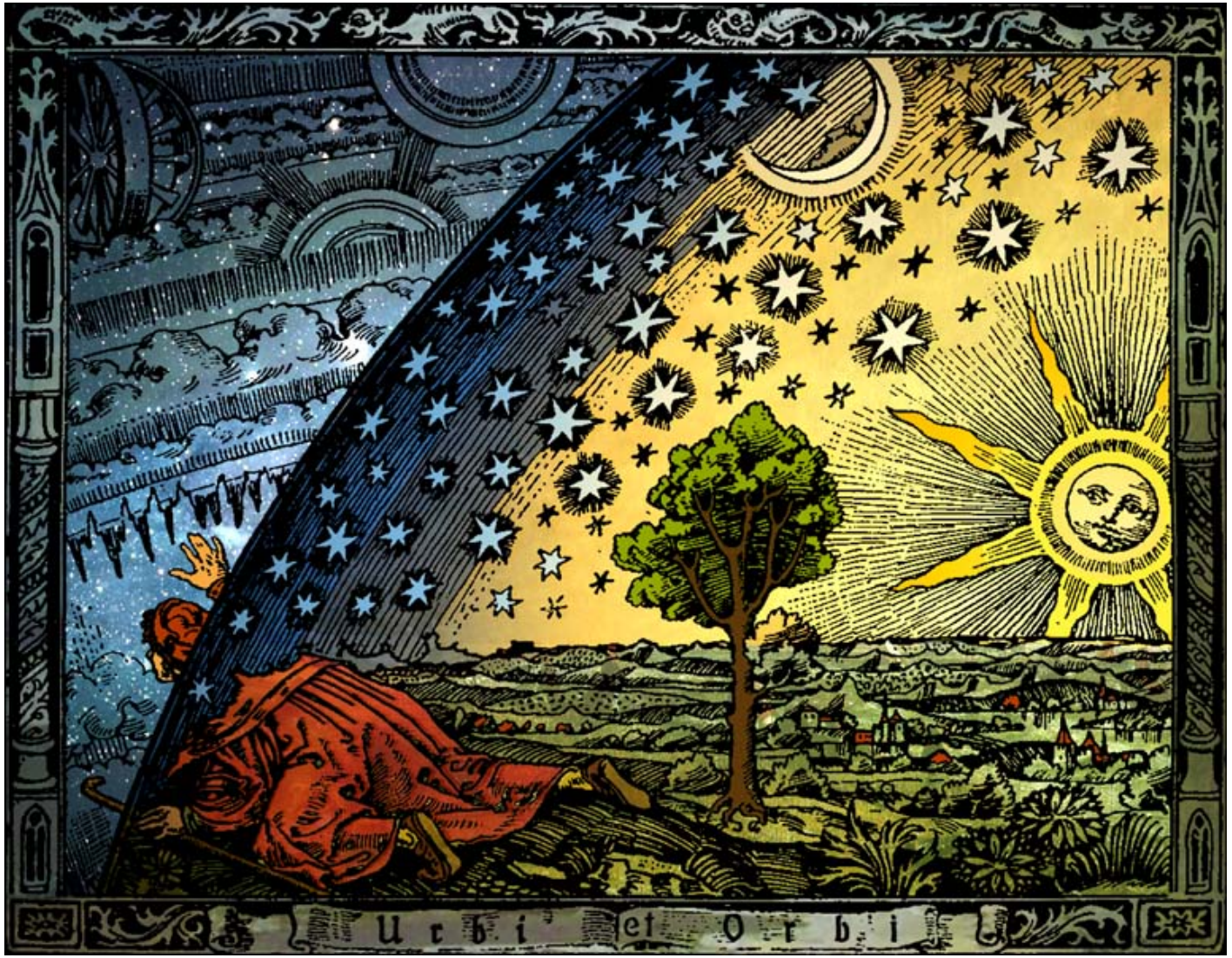
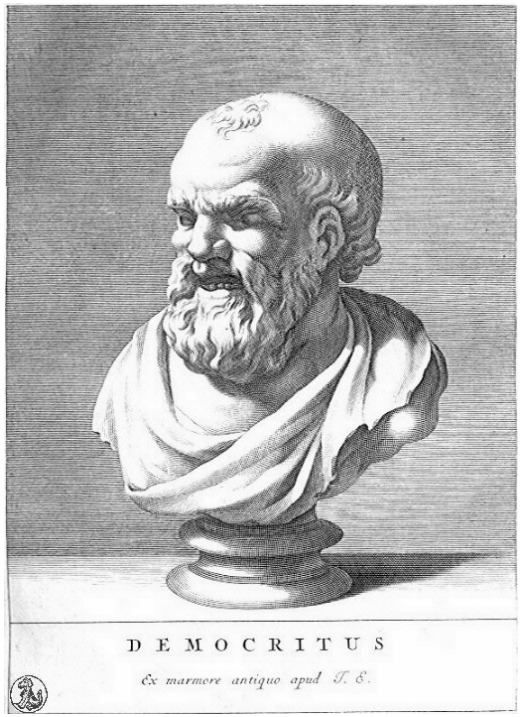
British physicist Peter Higgs congratulates Fabiola Gianotti, ATLAS experiment spokesperson, after her results presentation during a scientific seminar to deliver the latest update in the search for the Higgs boson at the European Organisation for Nuclear Research (CERN) in Meyrin near Geneva on Wednesday
AP
CERN physicists hail evidence of game-changing discovery of subatomic particle
Nato il 4 luglio, il boson
presenta al mondo. Ecc
scoperta la "particella
2. 遺伝子技術が変える世界
3. スーパーフレアの脅威
4. 並行宇宙は実在する
5. 無私は最高の戦略
編集部のピックアップ
1. 最悪のシナリオ
2. SARSが残した本当の脅威
3. 最強加速器で発見
4. HIVに感染しない細胞
5. 脳はなぜ左右で分業したのか
Contents
最新号の紹介
万物に
れ，世界
わたって
た。LHC
者が参加
歴史的
見いだした。そこを出発点に，万物に質量を与えるにはどうすればよいか考え，多くの物理学者の研究が組み合わさって，複雑精緻なメカニズムが構築された。「ヒッグス粒子」はそのメカニズムの象徴的存在といえる。
日本人物理学者も大きな貢献をしている。質量を与えるメカニズムの根本である「対称性の自発的破れ」
唱した。LHCの加速器や実験装置には日本の高度な産業技術が数多く用いられており，実験でも日本は中
なっている。
ただ，これで素粒子物理学が完結するということではまったくない。それどころか今回の新粒子の発見は
始まる幕開けだ。LHC実験が進めば，新たな驚きがもたらされる可能性もある。

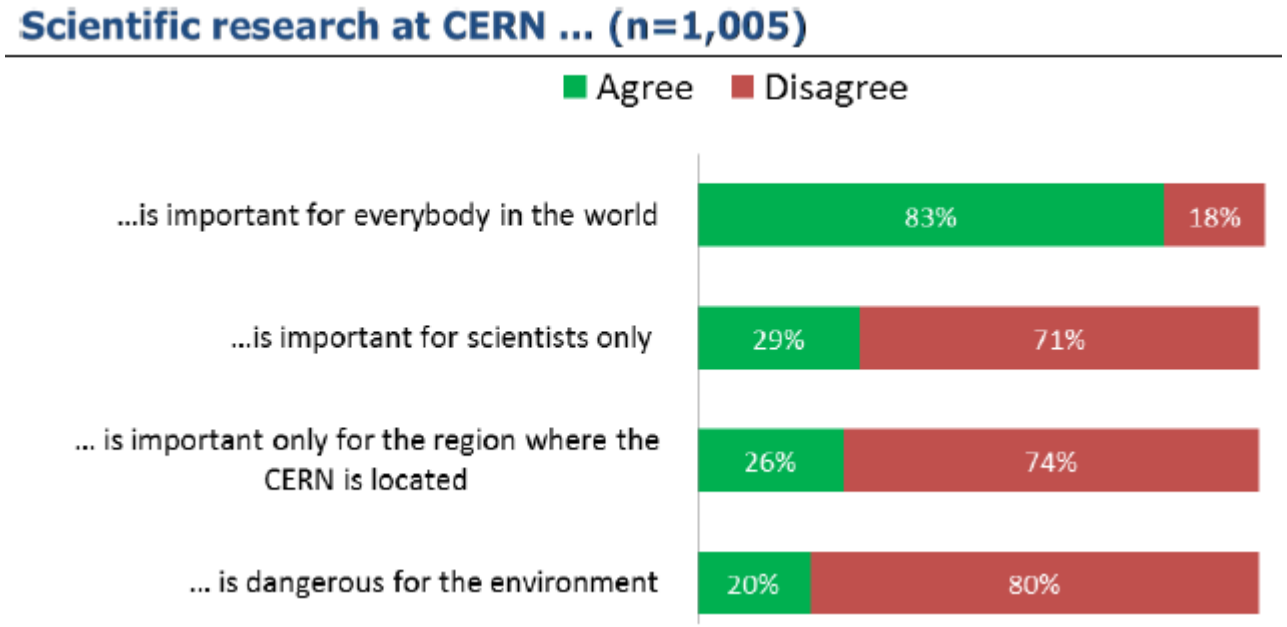




- Where do we come from?
- What are we made of (and the things around us?)
- What are the rules behind all this?

Explanation

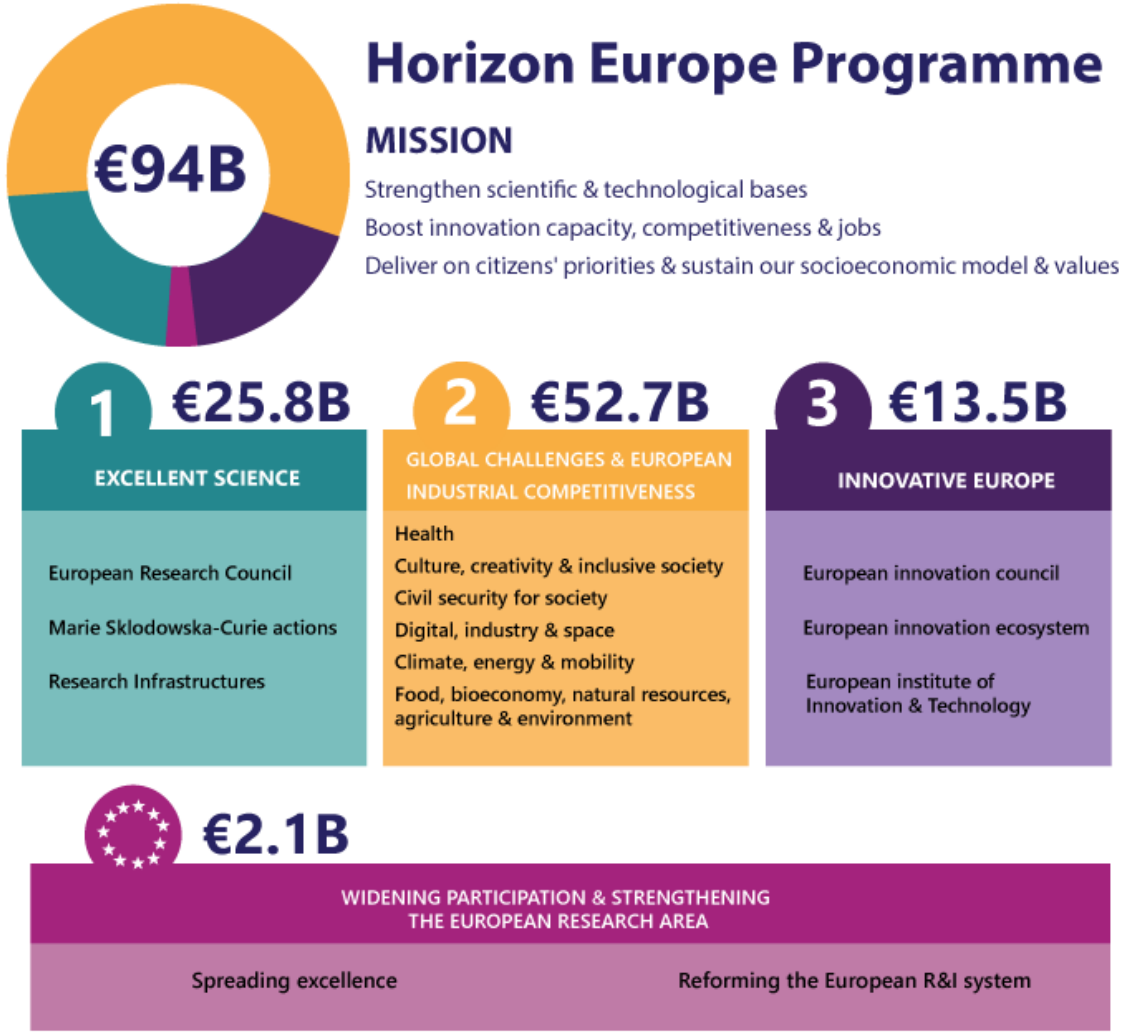
Taxpayer Fundamental research



From: Scientific Research at CERN as a Public Good: A Survey to French Citizens M. Florio et al. (2018) http://cds.cern.ch/record/2635861

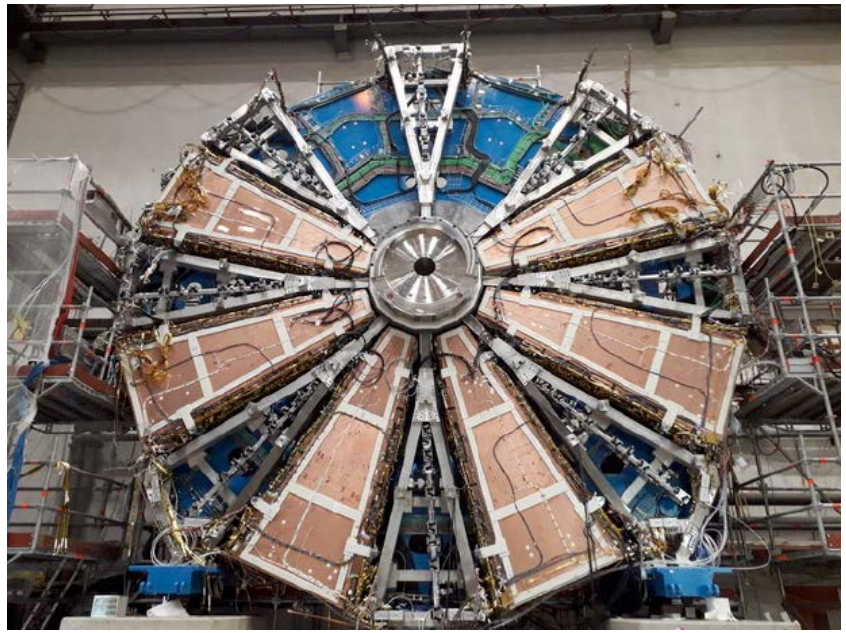
A price worth paying R. Heuer (2020) https://cerncourier.com/a/a-price-worth-paying/

Explanation **Legitimation**

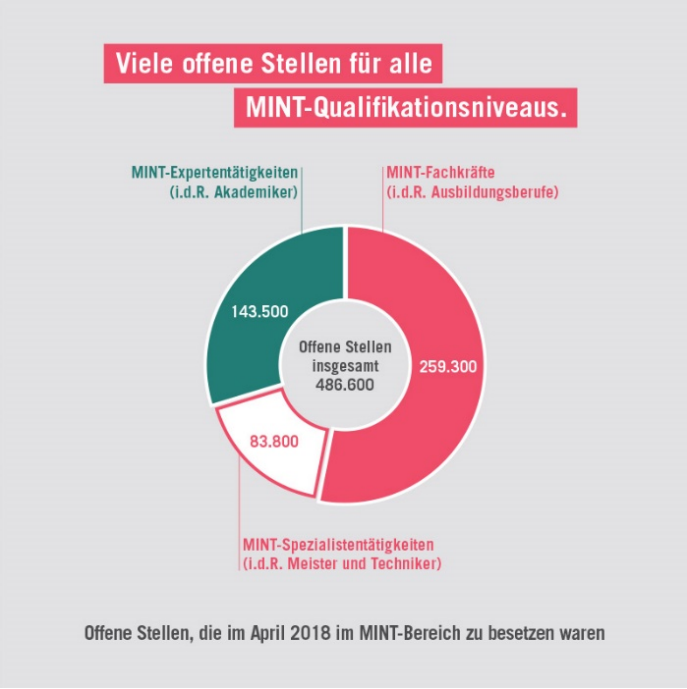


Explanation Legitimation **Visibilty**

HL-LHC: High Luminosity LHC
LS: Long Shutdown
TeV: Tera electron Volt

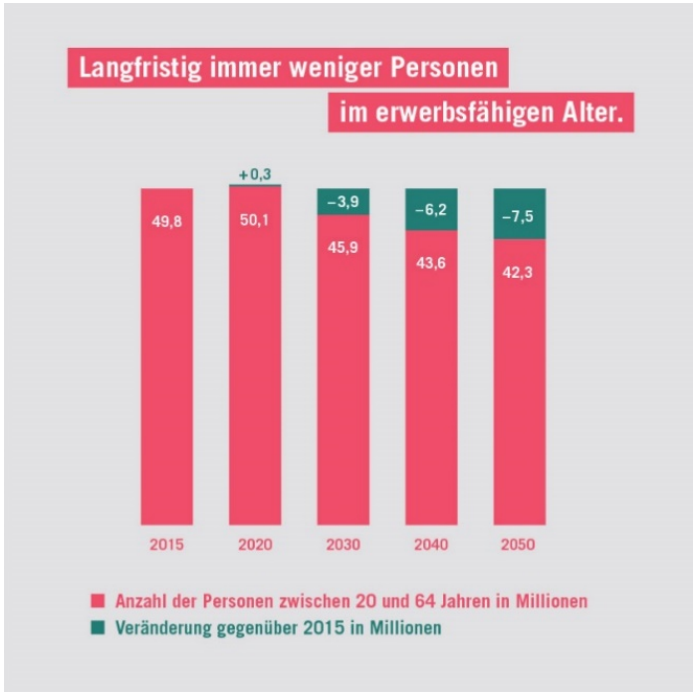


Shortage of STEM Specialists



490.000 open positions in STEM
Green: academic background

Number of open positions
is growing

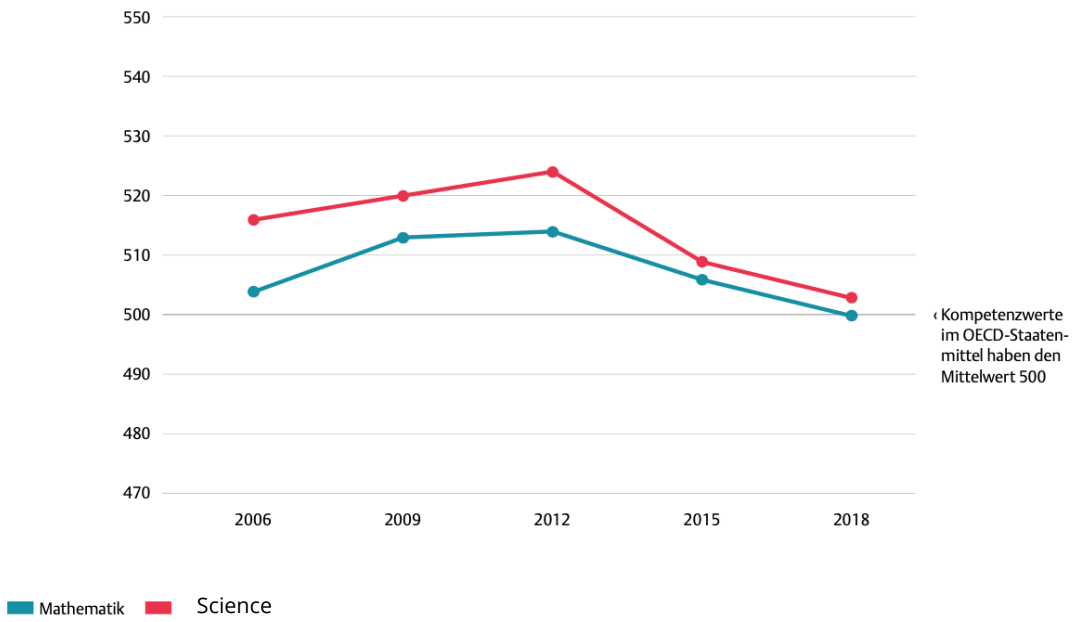


Number of working-age
persons is decreasing

https://www.insm.de/insm/themen/arbeit/fakten-fachkraeftemangel

STEM Young talent barometer

Performance of 15-year-olds in Germany



Datenbasis: Reiss et al. 2019

- performance of 15-year-olds declining since 2012
- Girls' and boys' performance is similar, but mainly because boys' performance deteriorates
- Girls have less interest and self-confidence in mathematics, chemistry and physics than boys, despite comparable performance
- Motivation, interest and professional self-confidence decreased

https://www.koerber-stiftung.de/mint-nachwuchsbarometer

More findings from MINT Nachwuchsbarometer

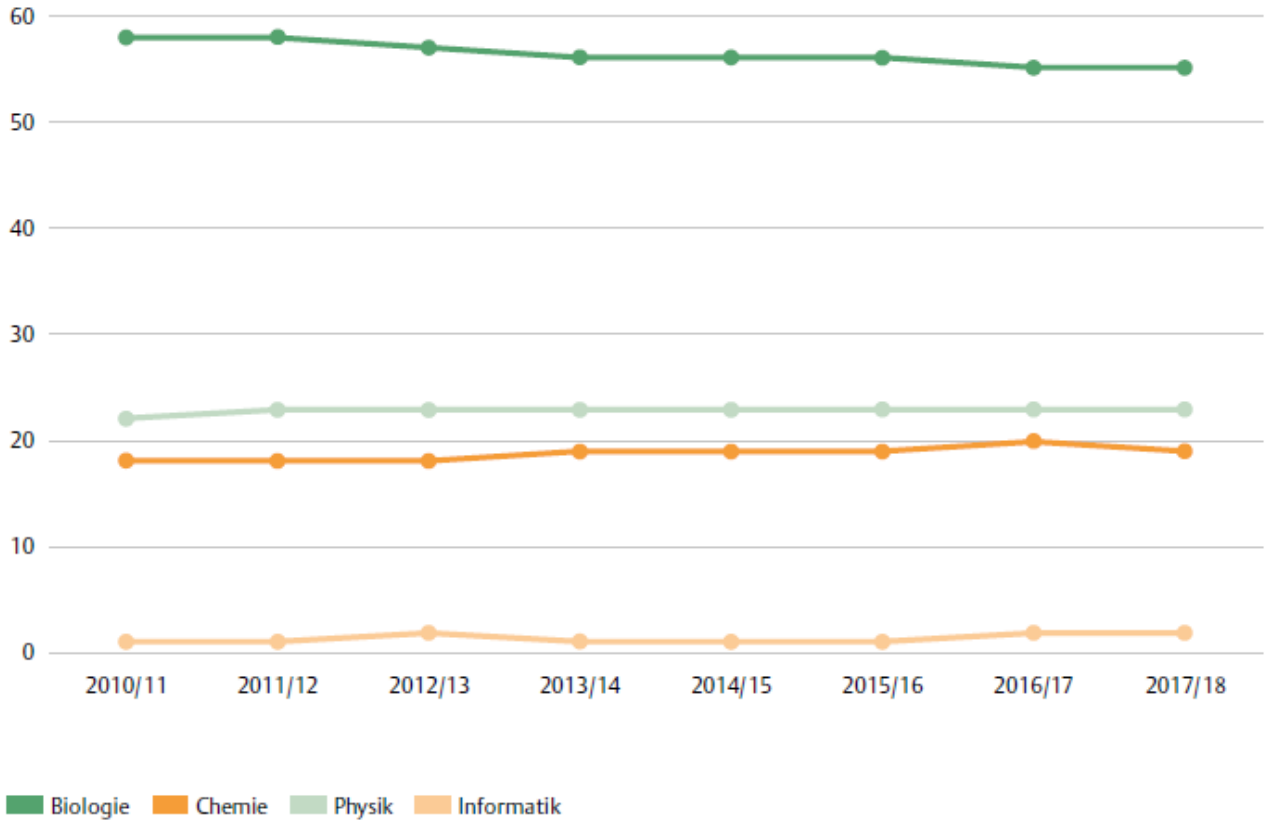


Abb. 7 **Leistungskurswahl/Profilwahl: Jungen und Mädchen in naturwissenschaftlichen Kursen auf erhöhtem Anforderungsniveau nach Schuljahr** (in Prozent)

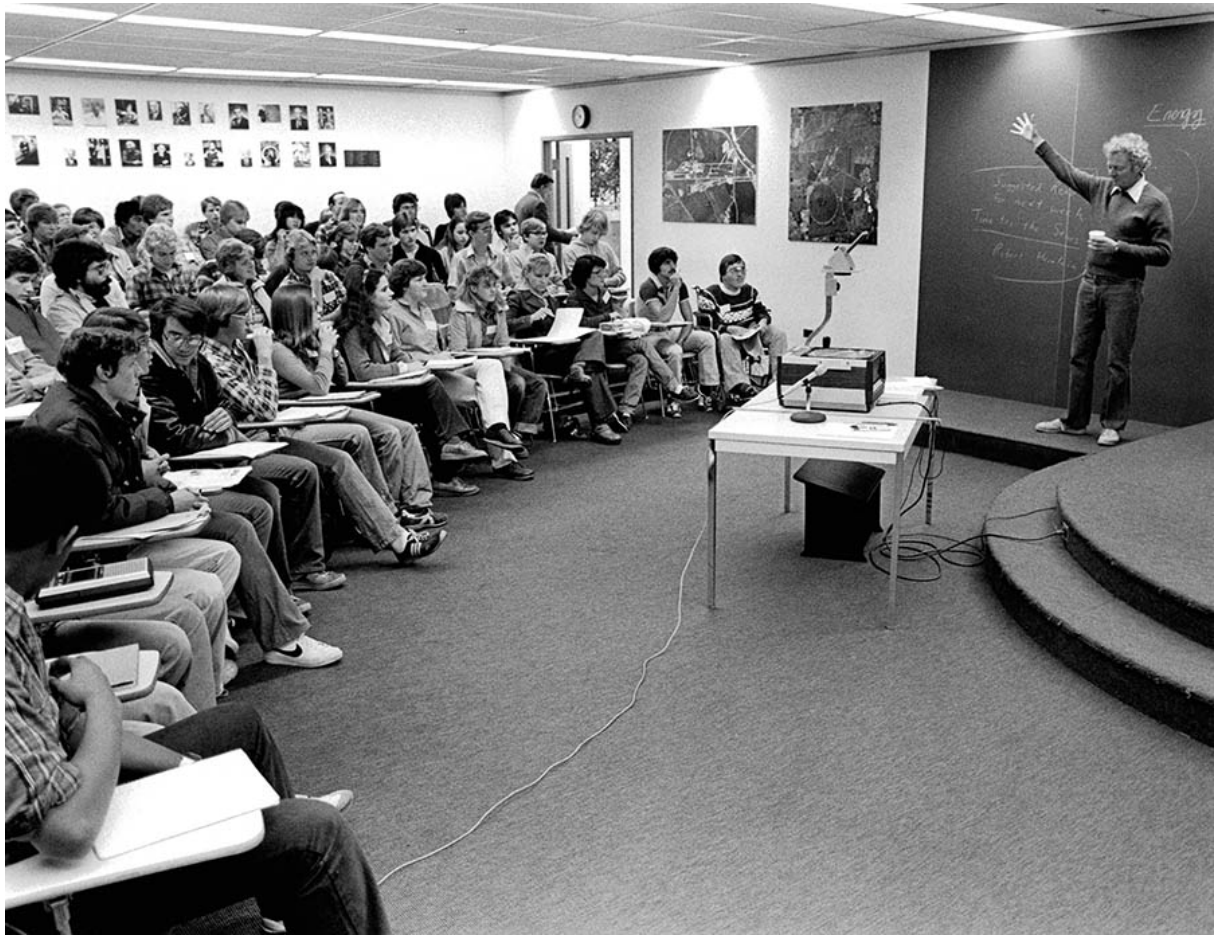
Low percentage of girls in physics and computer science courses:

- Biology: 60 %

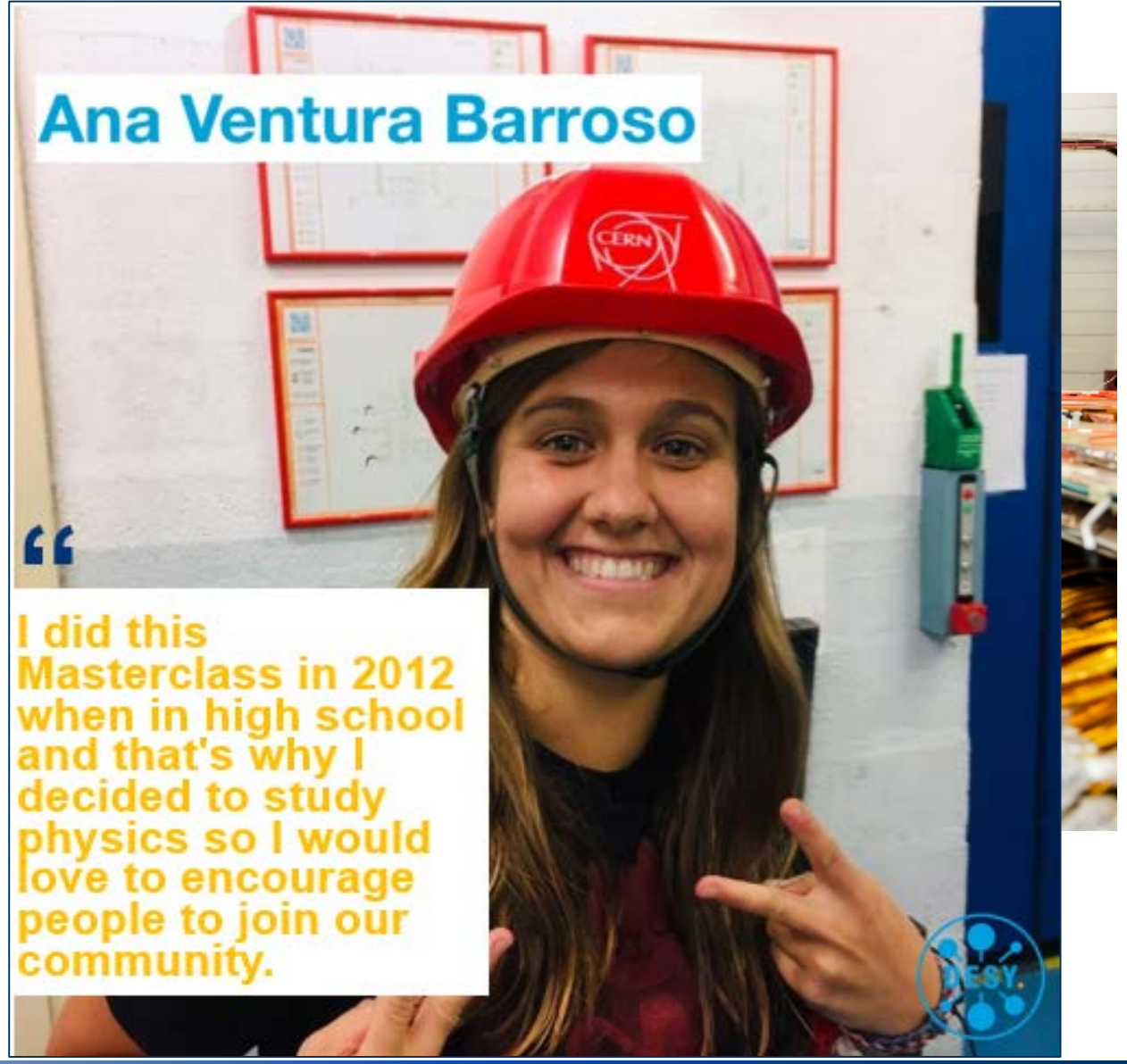
- Physics: 25 %

- Computer Science: 15 %

Professional specialization decisive for choice of field of study and professional development!



Leon Lederman, 1980ies



Explanation Legitimation Visibilty **Next generation**

QAA Podcast on Twitter: "Tonight's epi...
twitter.com

CERN AND THE GATES OF HELL | ВКонтакте
vk.com

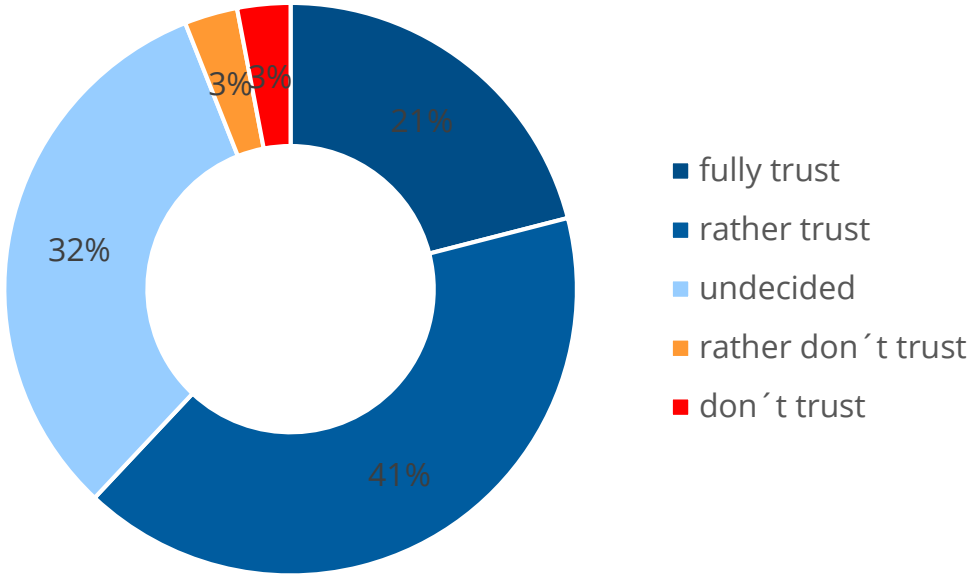
Pin on For the Home
pinterest.com

CERN Concern News - Home | Facebook
facebook.com

LHC
pinterest.com

JULY 5, 2022. WILL A PORTAL TO HELL WILL ...
theworldhour.com

"How much do you trust science and research?"
Wissenschaftsbarometer 2021

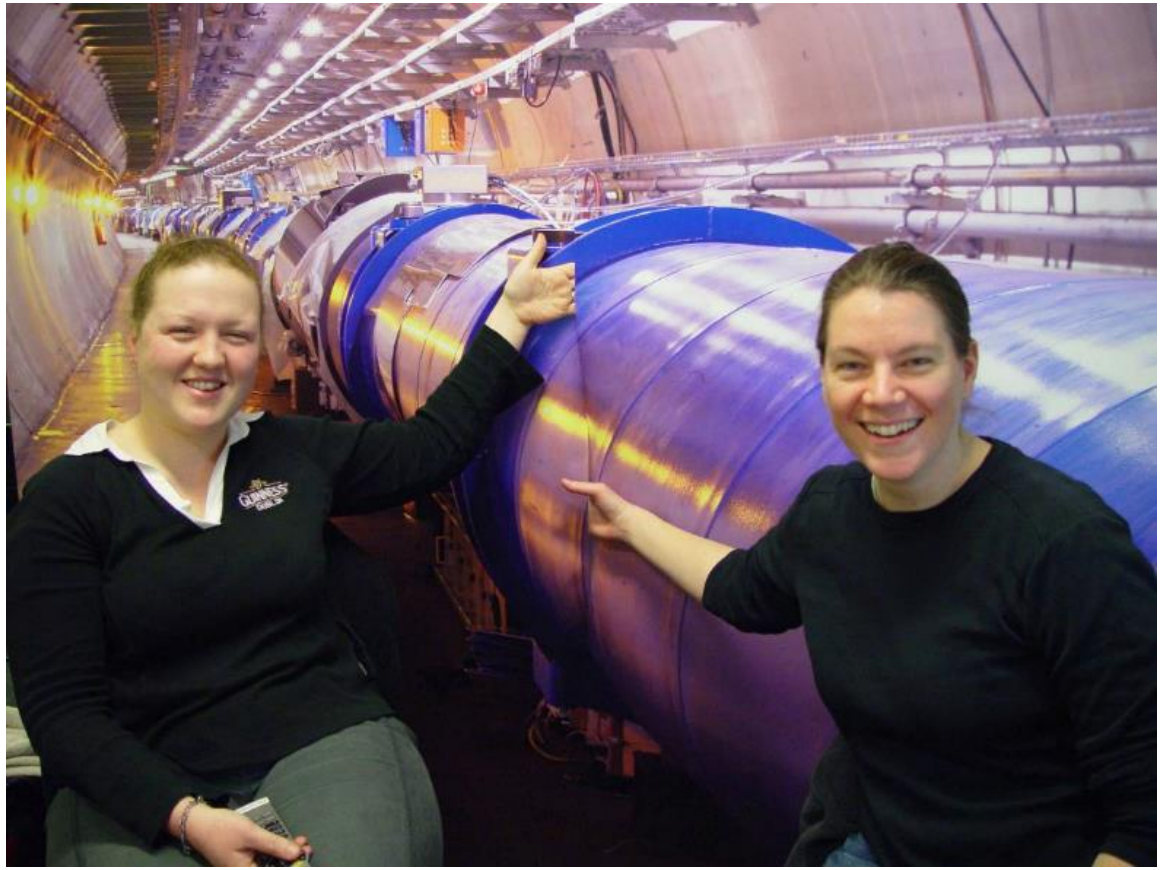


Source: Wissenschaft im Dialog/Kantar

Quotes from Masterclasses moderators:

“The best thing is actually answering the questions and seeing how excited and how happy they are, waving at the camera. They're really excited to be talking to physicists based at CERN!”

“It is very satisfying, because we do many video conferences and rarely do people cheer on the other side if you say something. Here they do!”



BMBF Research Program ErUM (Exploration of Universe and Matter)

- Particle Physics Research is funded in ErUM

- 4 fields of action
  - Large Scale Facilities
  - Networking
  - STEM young scientists
  - Transfer & participation

MINT Nachwuchs
- Nachwuchs für MINT Fächer faszinieren
- Wissenschaftlichen Nachwuchs qualifizieren
- Karriereperspektiven schaffen

Transfer und Partizipation
- Wissenschaftstransfer von Forschung in Wirtschaft und Gesellschaft anregen
- Dialog zwischen Forschung und Bürgerinnen und Bürgern intensivieren

→ **Outreach is an integral component of research**

Actors

- Universities /research labs
  - Variety of local activities (Long Night of Science, Open Days, Physics on Saturday, Children´s University, School Lab, etc.)

- Netzwerk Teilchenwelt
  - Since 2010
  - Shared programs, structures, materials for outreach
  - Target groups: High school students, teachers, broad public
  - Whole field of smallest particles (Particle Physics, Astroparticle Phyics, Nuclear and Hadron Physics)

- LHC-ErUM-FSP Office
  - Since 2020
  - Joint communication and transfer office
  - Target groups: scientific community, industry, policy makers

- Belle II FSP Office, Outreach at GSI/FAIR...

Core: multi-step program for high school students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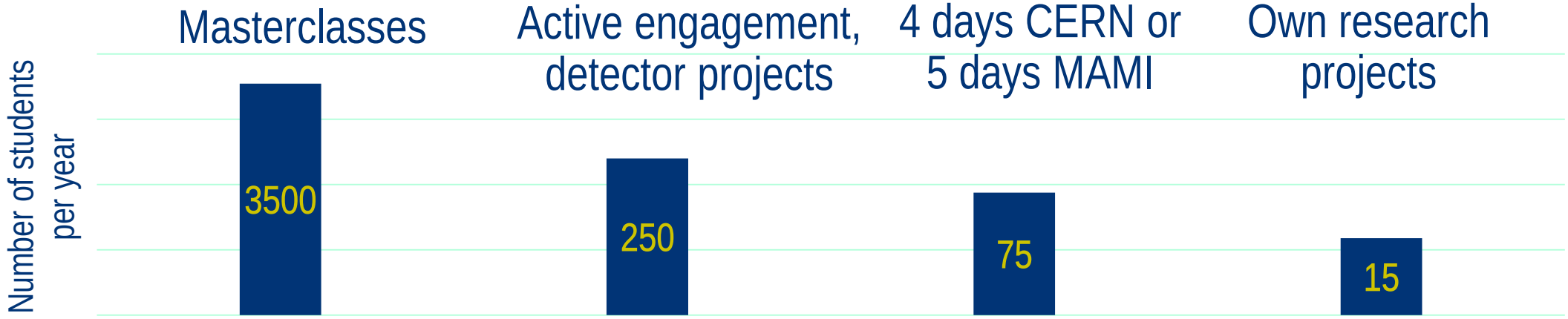
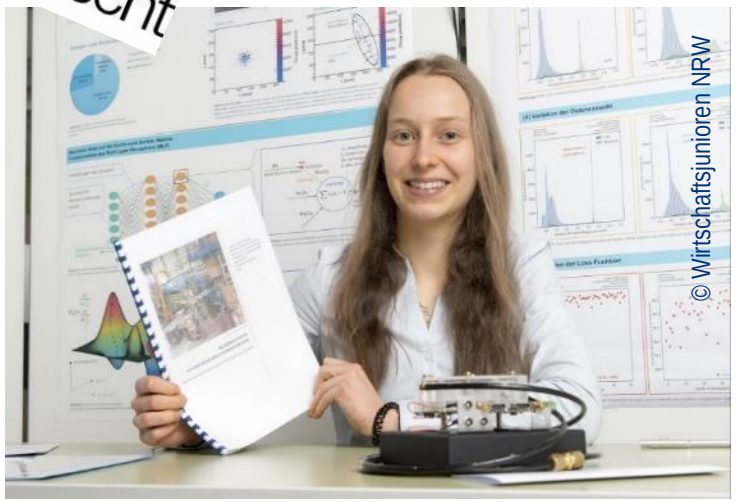


Own research projects: examples

- Deep Learning Models for Energy Estimation in CMS HGCAL L1 Trigger (Felix Hansen)
- First data classification at the InGrid detector at the CAST experiment using deep learning (Carolin Kohl)
- The AWAKE experiment (Björn Dörschel)
- The effects of radiation on the CMS pixel detector (Katharina Ploog)
- Machine-learning based identification of highly collimated electron pairs from boosted Z boson decays (Sophia Veneris)



Facilitators

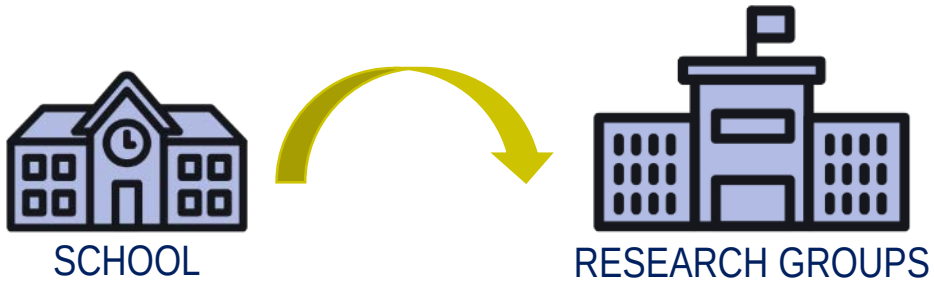
- ~ 150 PhD and Master students
- hold Masterclasses, supervise students´ research projects
- influence students´ career-related aspirations and choices

- reimbursement of expenses and travel cost
- get training courses on communication, didactics, and presentation techniques

- acquire soft skills, for personal and professional development
- experience interest in own research
- practice supervision

win-win

Fellow program



- 130 people, 50% female
- Mainly alumni of CERN workshops
  - Now often studying physics or shortly before that

→ Close connection between highly motivated students and research groups

Central offers: Fellow physics schools (HEP, detectors),"Ask the expert" sessions (online), national physics conference attendance, etc.

Local offers: internships, excursions, invitation to outreach events, colloquia, regulars´ table, etc.

Woche der Teilchenwelt (Week of Particle Physics)

- 02.11. – 06.11.2020
- A full week of events at many sites
  - Virtual visits, public talks
  - Science Café, Science Show, Science Slam
  - Masterclass
- COVID lockdown announced the week before

  →More virtual formats

  →Some cancellations
- Landing page, event calendar, social media, public relations

- Next edition: 06.11. – 12.11.2023

Higgs@10

- 10th anniversary of Higgs discovery on July 4th, 2022
- Celebrated worldwide
- Activities in Germany coordinated by LHC-ErUM-FSP Office
- Landing page, event calendar, social media, media relations
- Various activities at many sites

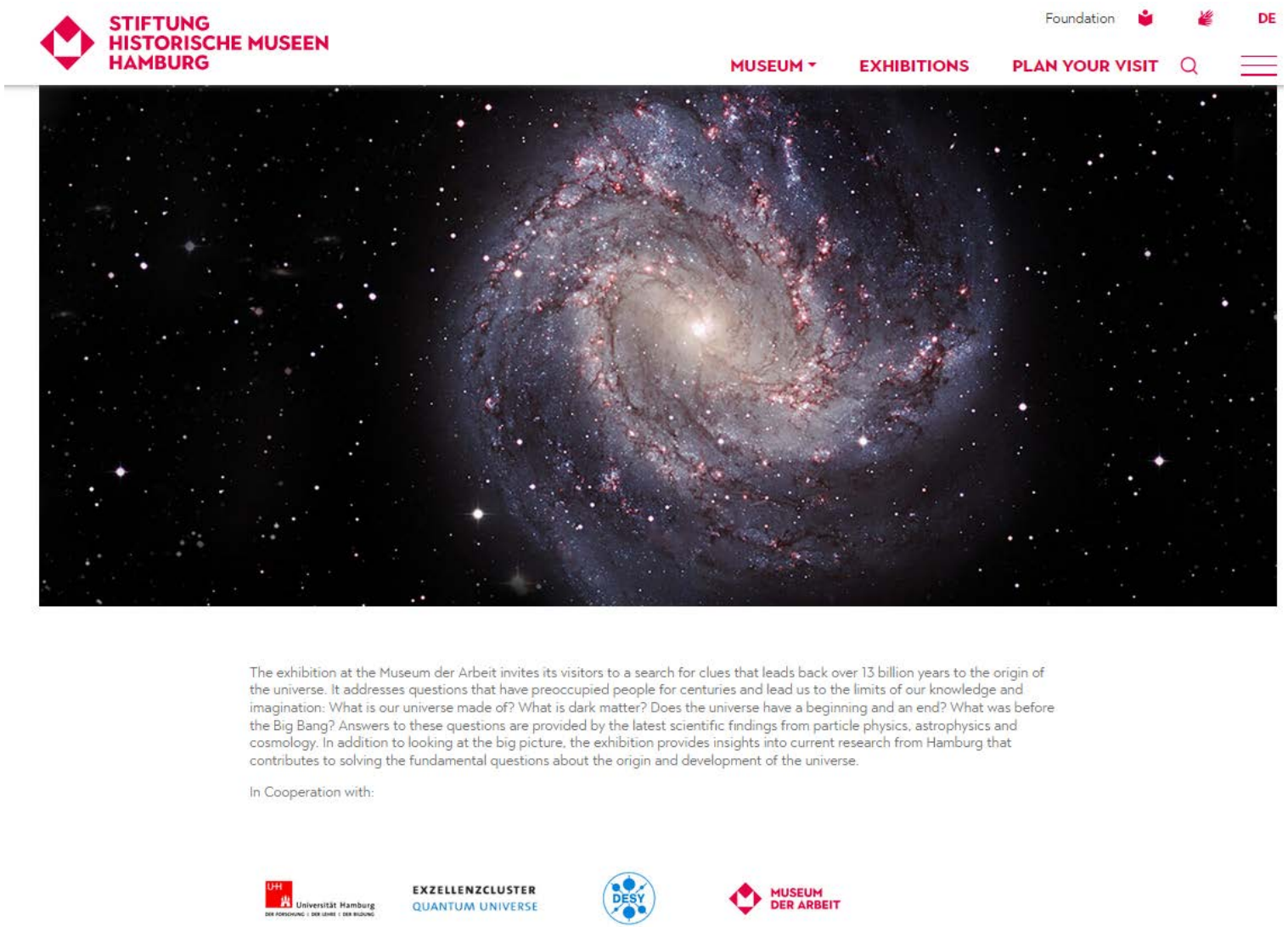
Ranga Yogeshwar and Arnulf Quadt
(ATLAS-FSP spokesperson)

Mainz: Physics at the Theatre

Exhibition 1: Urknall unterwegs

- Pop-up exhibition on particle physics
- Target audience: general public, people with less affinity for science
- Shown in public places (market place, pedestrian zone, ...)
  - Tunnel: time travel through the history of the universe
  - 2 Elements: Interactions and particles, Research methods, spin-offs
  - Pavilion with games (Particle Twister, Particle Yenga, Lego building blocks)

Exhibition 2: The beginning of everything



Summary

- Informing the **public** is our duty as scientists
- Inspiring the **next generation** is an important task
- Outreach brings **personal benefit**

- Outreach is **integral part of our research**
- **Lots of opportunities** to engage, well-structured outreach programs, diverse set of activities, professional support

- Existing programs and structures create **multiple benefit**
  - win for **high school students**: experience modern research first-hand
  - win for (**PhD**) **students**: train their communication skills, participate in a rewarding activity
  - win for **physicists**: get young talents for the research groups