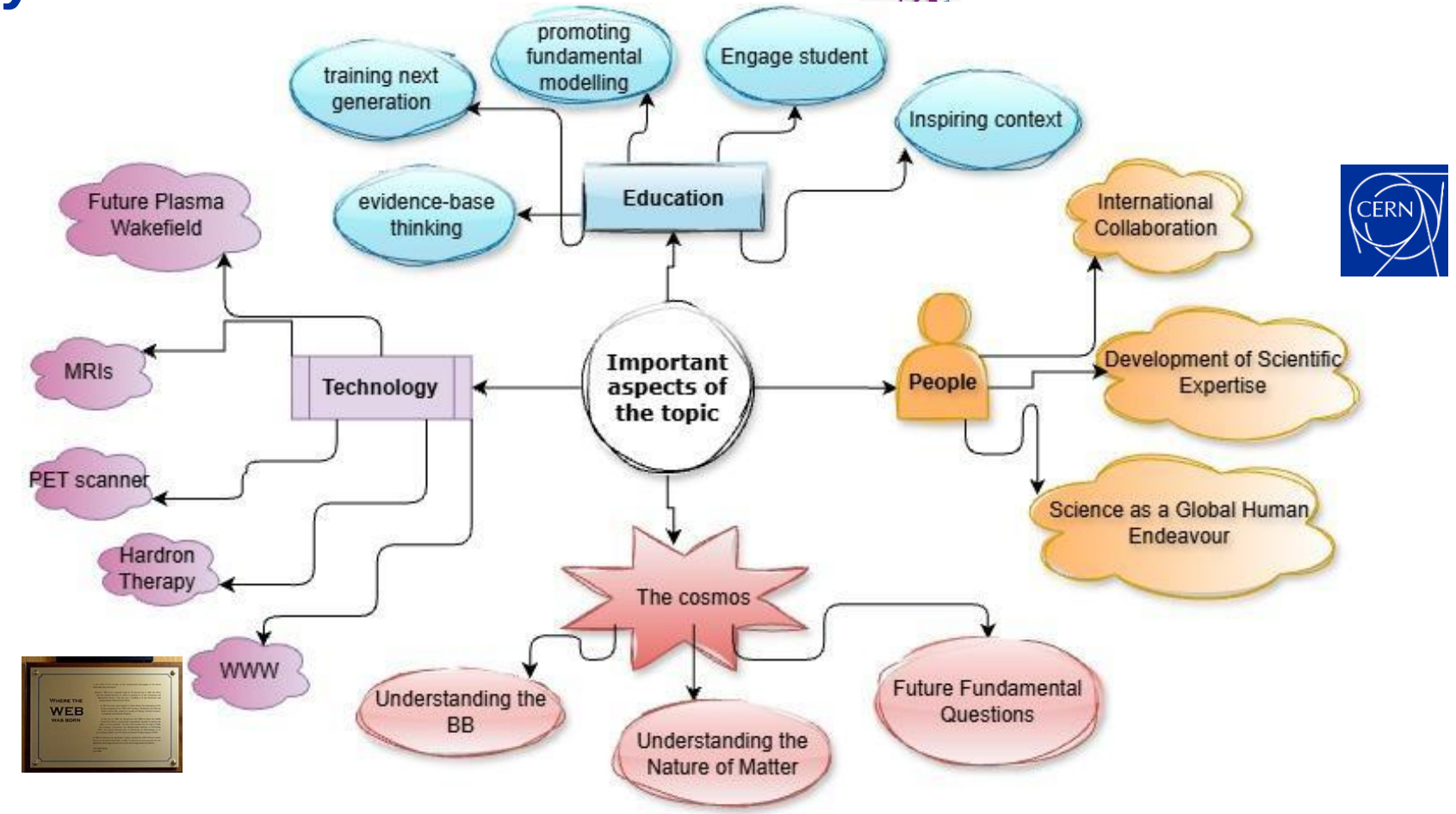
APPLICATIONS OF PARTICLE PHYSICS

(The meaning of life the universe and everything?)

HST2026 Study Group 4

Key Ideas


Important aspects of the topic
Education
training next generation
promoting fundamental modelling
Engage student
Inspiring context
evidence-base thinking
Technology
Future Plasma Wakefield
MRIs
PET scanner
Hardron Therapy
WWW
People
International Collaboration
Development of Scientific Expertise
Science as a Global Human Endeavour
The cosmos
Understanding the BB
Understanding the Nature of Matter
Future Fundamental Questions

WEB

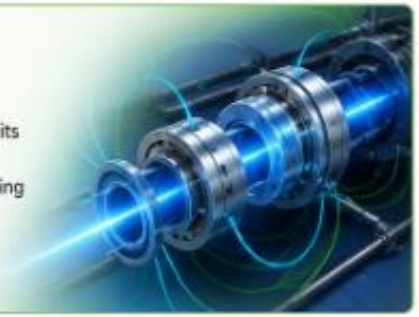
Curriculum & Classroom Connections

NATURE OF SCIENCE

- The history of science and the development of the standard model.
- The nature of science and how ideas advance through collaboration.

FIELDS

- Lorentz force and its utility at CERN in guiding and focusing the beams.

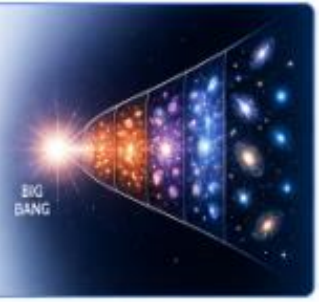


RADIOACTIVITY

- Medical applications topic in the context of radioactivity.
- The breadth of applications that are being developed.

ASTROPHYSICS

- The understanding of the early universe that is only accessible through particle physics.
- The recreation of the immediate aftermath of the HBB.



APPLICATION IN MEDICAL PHYSICS

- Accelerators in Medicine.
- Examples: hadron therapy, PET scanners and other medical applications.

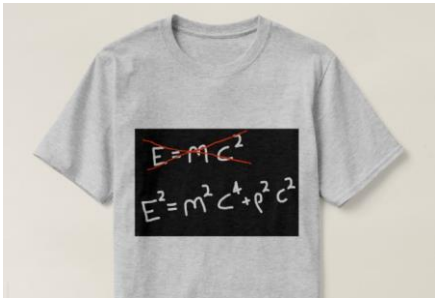
SCIENTIFIC COMPETENCIES

- Particle physics may seem difficult to integrate into a concept-based curriculum. However, a competency-based approach allows us to use it as an authentic context for developing scientific understanding and practices.

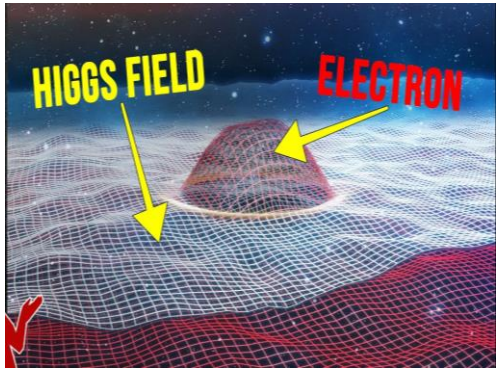
Potential Students' Conceptions & Challenges

The difference between antimatter and dark matter. Particularly the reality of antimatter and the mystery of dark matter.

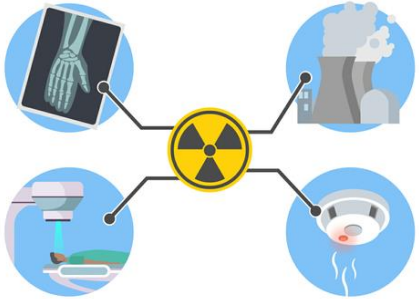
The idea of particles gaining momentum rather than mass when they approach the speed of light.



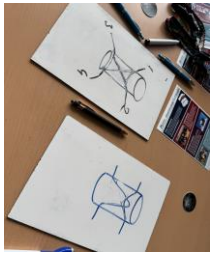
What the Higgs Boson actually is in simple terms and how it links to the other fundamental particles.



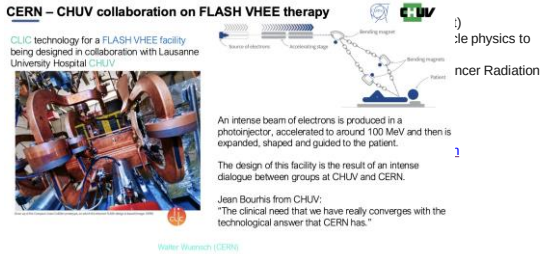
That radiation is common, we are exposed to it everyday and that often it is very useful.



Useful Material & Resources



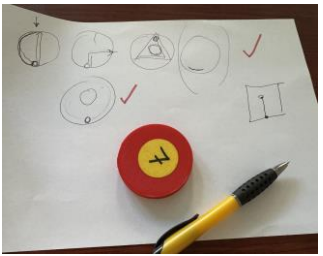
The speed talking activity to understand the foundation of a topic and the limits of existing knowledge.



The resources from the perimeter institute and the philosophy of predict-explain-observe-explain.

Application of Particle Physics in High School

Accelerators in Medicine - The development of Cancer therapy



Introducing the ideas of inference via mystery boxes.

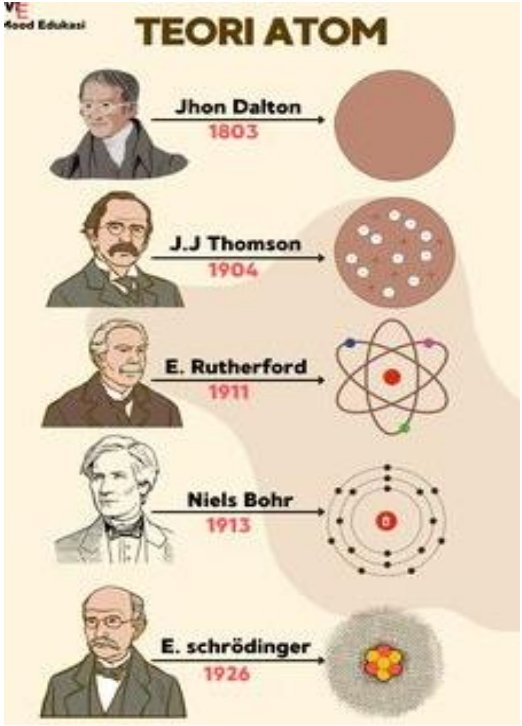
Dose Game to see commonality of radiation

Best Practice Example

How can studying particle physics improve human life? :

Speed Talking : Find a discussion partner, between the two of you, decide who is “A” and “B”. Each person will use 20s to tell your partner everything that comes to mind about the word.

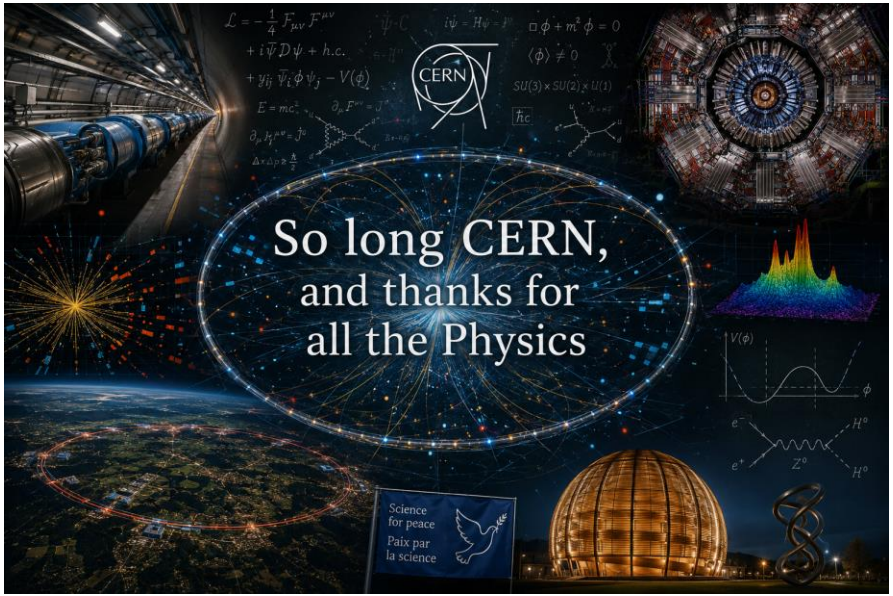
Case Study Carousel : Each station focuses on one application. **Cancer Therapy, Medical Imaging, The World Wide Web, Development of Atomic Models .**



HST2026 Study Group 4

Katia (France), Andres (Spain), Will (England), Daranee (Thailand)

One way in which our thinking has changed…

- **Katia - the fact that science is evolving and that nothing is fixed.**
- **Will - We were surprised by the sheer range of career opportunities linked to CERN, engineering, medical, computing and how they all link to particle physics.**
- **Andres - That even the most challenging particle physics can be taught and understood in schools.**
- **Daranee - Even abstract topics can be modelled practically.**

Highlights- **Everything, it was brilliant!**