The Abdus Salam International Centre for Theoretical Physics

United Nations Educational, Scientific and Cultural Organization

IAEA International Atomic Energy Agency

ICTP 1964–2024

UNIVERSITY OF SUSSEX

Physics to Address Global Challenges to Achieve the SDGs by 2030

Sustainable HEP 2024

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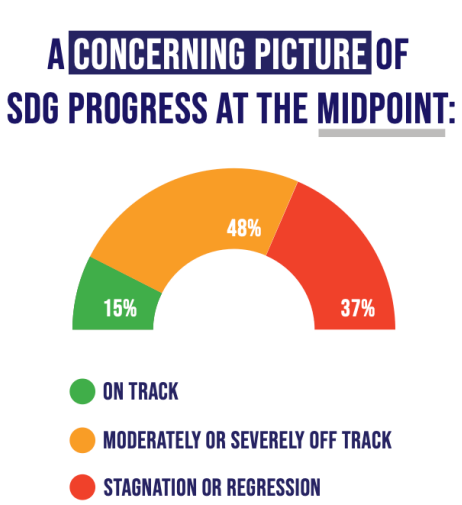
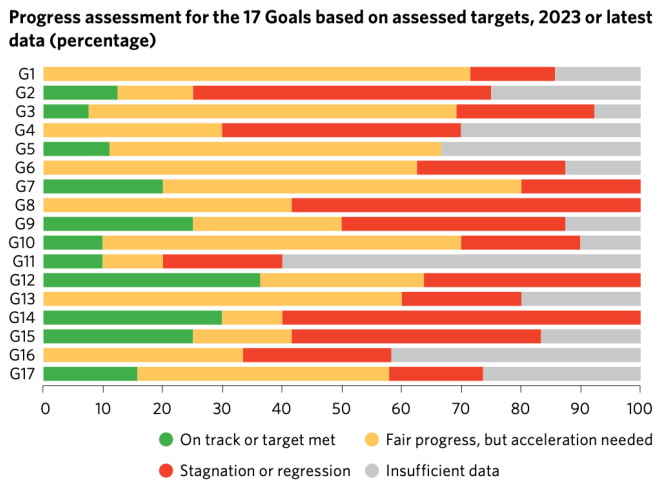
@KateShawOnline

Sustainable Development & SDGs

Towards digital and green economies

- Countries at all income levels are looking to transition towards digital and green economies
- This vitally involves investment into science, and accelerating technology transfer into industry
- To reach SDG by 2030 countries will need to invest more into research and innovation

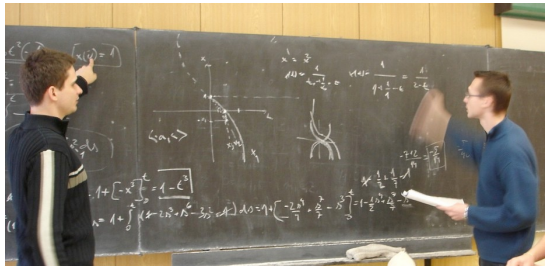


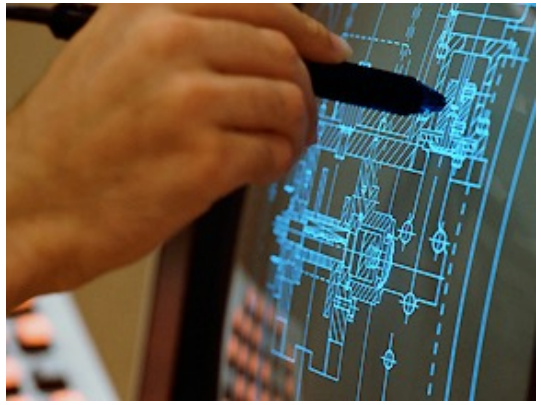


The Sustainable Development Goals Report: https://sdgs.un.org/documents/sustainable-development-goals-report-2023-53220

Sustainable Development

Physics and Fundamental Science





Fundamental Science

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Applied Science

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Technology, Engineering and Innovation

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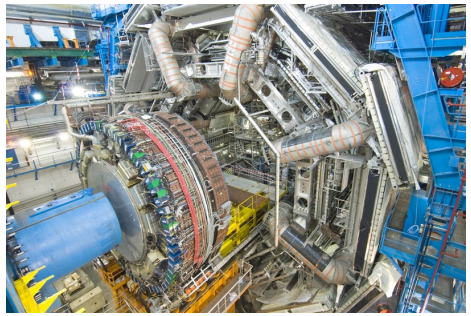
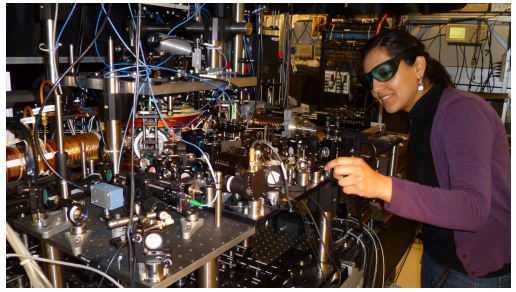
Sustainable Development





Sustainable Development

Towards digital and green economies

- The need to solve environmental and developmental problems requires scientists and scientific and educational institutions

- Education and investment into educational, technological and cultural institutions play a key role in growing a knowledge-based economy

- Scientific research at universities drives and improves the level & quality of education at all stages

Sustainable Development

Towards digital and green economies

How can physics help address challenges and achieve the SDG by 2030

1. Open Science and Open Data are a vital part of the pathway towards the SDG goals, and important for accessibility to science
2. Through outreach and education we can improve Scientific Literacy across the world, supporting **Quality Education** and **Reduce Inequalities**
3. Science must be for all, access to science and scientific training is vital, we must increase the access to careers in research to students, in particular from minority groups and low-income countries
4. International cooperation is another important pathway, must be encouraged especially between countries in Global South, which can support **Peace and Justice**

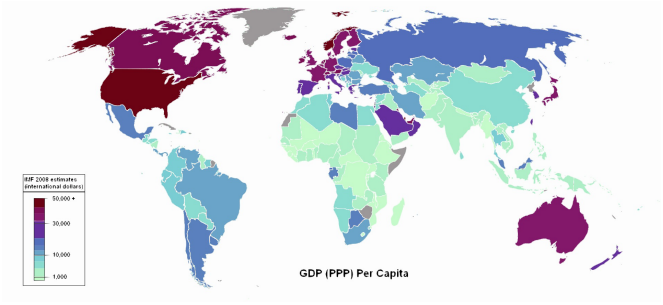
1 Open Science

United Nations Educational, Scientific and Cultural Organization

Open Science

Open science is an accelerator for the SDG 2030 and a powerful tool to bridge the science divide between and within countries

Open Science is about allowing scientific **information**, **data** and **outputs** to be **open**, **accessible** and readily **harnessed** to all.



Helps to **bridge the gap** between developed and **developing country's** access to science, scientific capabilities, and outputs to support **sustainable development.**

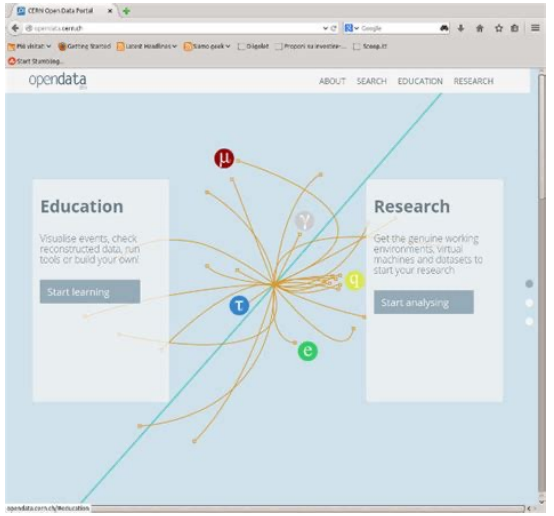
Helps to promote **equal opportunities** for all scientists and citizens and increase **scientific capacity** and **science education.**

1 Open Science

Large Hadron Collider at CERN

CERN develops and uses some of the most complex machines in the world! CERN is dedicated to the open science movement to ensure researchers, students and the public can access and analyse LHC data.

ATLAS OPEN DATA: opendata.atlas.cern/data/



Focus on

- ATLAS
- ALICE
- CMS
- LHCb
- OPERA
- PHENIX
- Data Science

Open Data Portal : opendata.cern.ch

2 Scientific Literacy

When UNESCO's High-Level Reflection Group met in October 2020, economist Fouad Laroui observed that

'science is in crisis. We have seen it clearly during the pandemic but also in relation to climate change. Over the last 20 years or so, we have seen growth in the idea that science is just a belief like any other. This is very dangerous.' 3

Unesco science report 2021

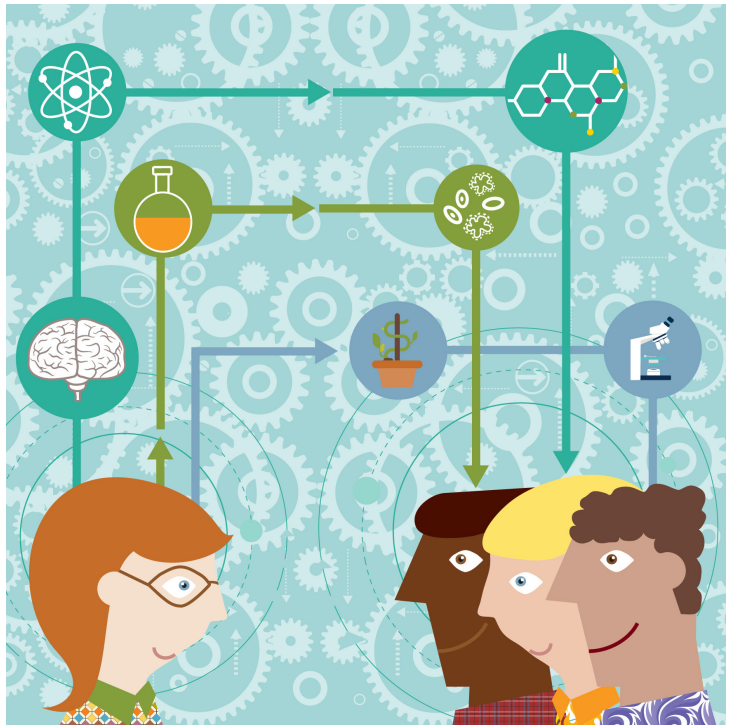
2 Scientific Literacy

- Scientific literacy targets the wider population (non researchers) through science **communication**, **education** and **outreach**

- School students benefit from learning enquiry based learning (**observation**, **measurement** and **experimentation**)

- Understanding scientific discovery thrives on uncertainty – continual readjustment with new facts (decision makers give definitive answers to complex questions)

- For science to be for the benefit of humanity, that system must include a scientifically literate population



3 Physics for all

Monoculture can create mono approaches – everyone may use same approach when they have the same culture, background, and experiences

If certain groups are under-represented, our **talent pool** is smaller

A group of people with different experiences and perspectives brings **innovation** and **creativity**

3 Physics for all

However we must work to further **diversify** science

- Many groups are under-represented in physics (aspects such as gender, sexuality, ethnicity, social-economic background, geographical location)

- We must work for scientists under represented countries such as the **Global South** to have equal access and voices to agenda

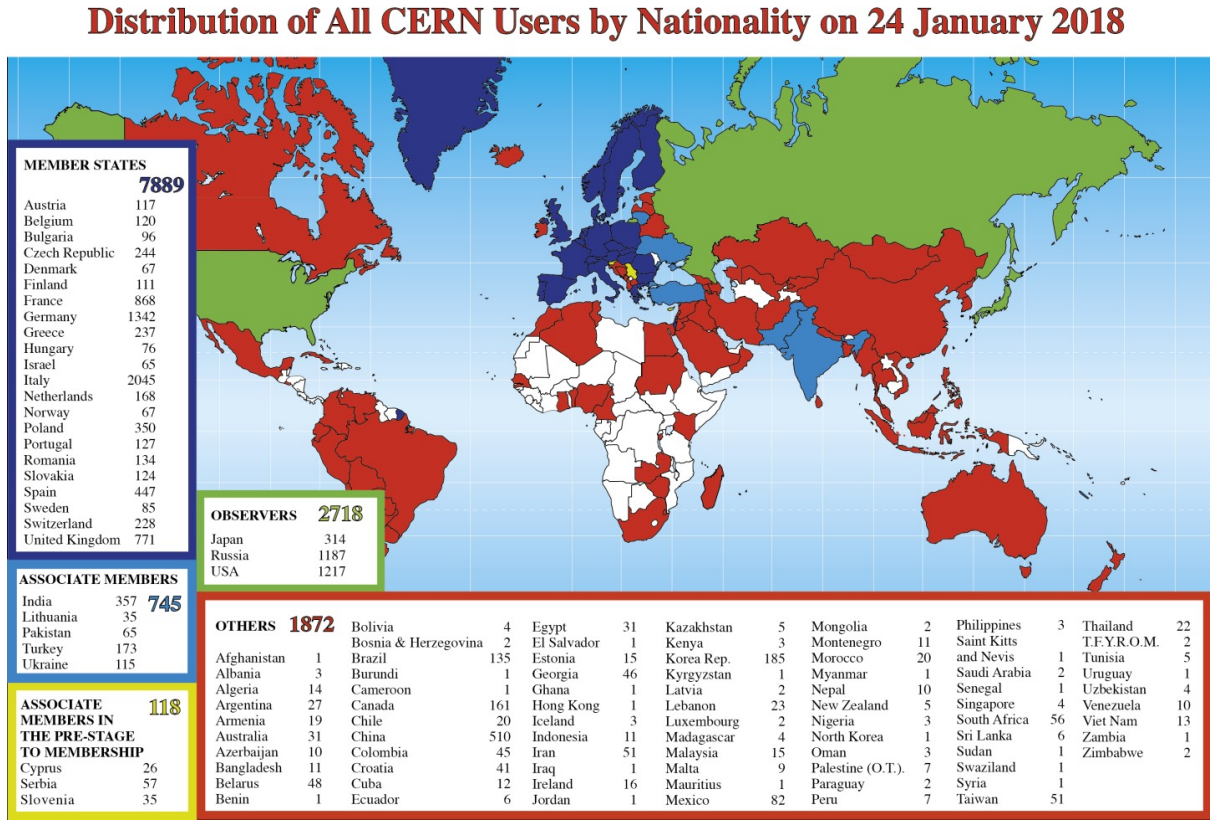
- many scientists do not have the same access to funding and governmental support as others, cannot afford to access journals or attend workshops and conferences

- many students and young people lack exposure, access and opportunity and network

Dr Wafaa Khater, Birzeit University, Palestinian Territories.

4 International Cooperation

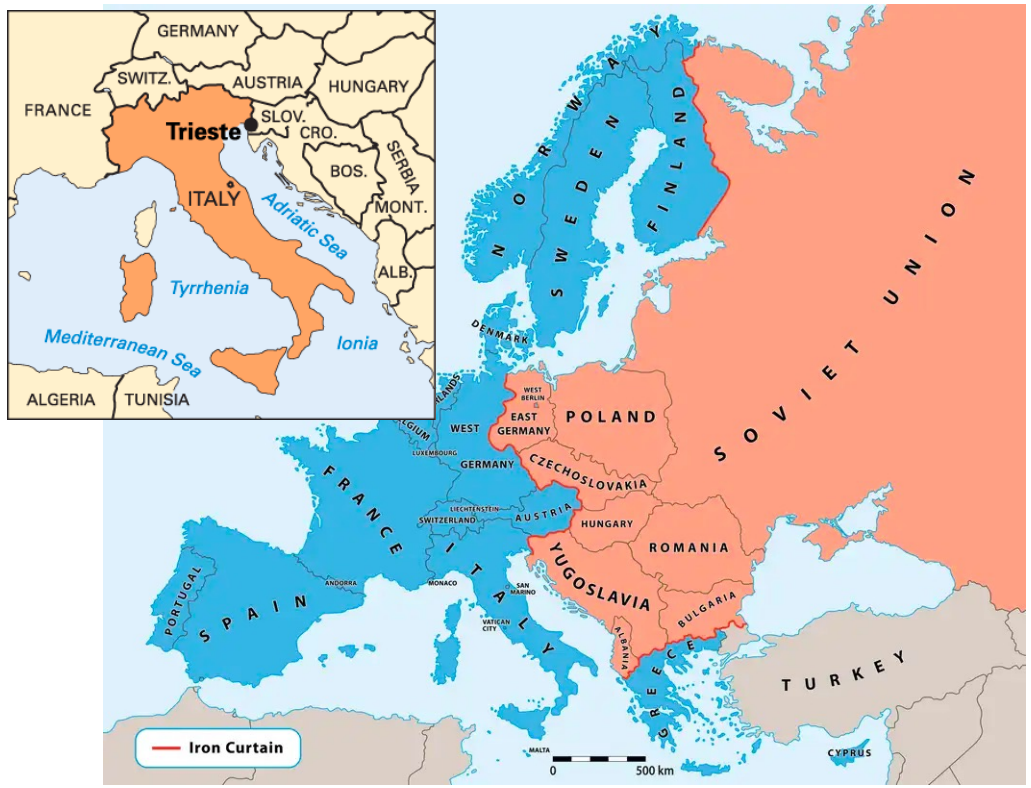
- International cooperation builds bridges across nations, **soft diplomacy** has real impact! We must intensify and improve **scientific cooperation** between countries
- Today, CERN has become a model for cooperation in terms of research, embodying the 'one-earth' approach that the world needs to tackle the global challenges we are facing.
- Today CERN has **23** member states, and many countries participate, Over 11000 scientists from ~100 nations use CERN's laboratories.



Working for Science for Peace!

4 International Cooperation

ICTP



The international Centre for Theoretical Physics (ICTP), Trieste, Italy.

During the Cold War era in the heart of Europe, a continent separated by the iron curtain, ICTP provided a rare line of communication between scientists from the East and West, and those from developing nations.

4 International Cooperation

SESAME

- The Synchrotron-light for Experimental Science and Applications in the Middle East, Allan, Jordan.
- Pooling resources to build scientific capacity within the region, create research and career opportunities that can limit the brain drain
- Functions as a bridge between its diverse culturally and politically conflicting societies
- Building a community to address scientific and developmental challenges together

Summary

- Science is a vital component of the path towards the SDG to be achieved in 2030
- We must push for more accessibility in science, for Open Science and Open Data, and impress the importance of science literacy
- Must provide funding and opportunity for outreach, communication and education in physics to increase scientific literacy
- International cooperation is vital and must be invested into further, and scientists from the Global South must have more access to science

ictp.it/home/physics-without-frontiers
@ictpPWF

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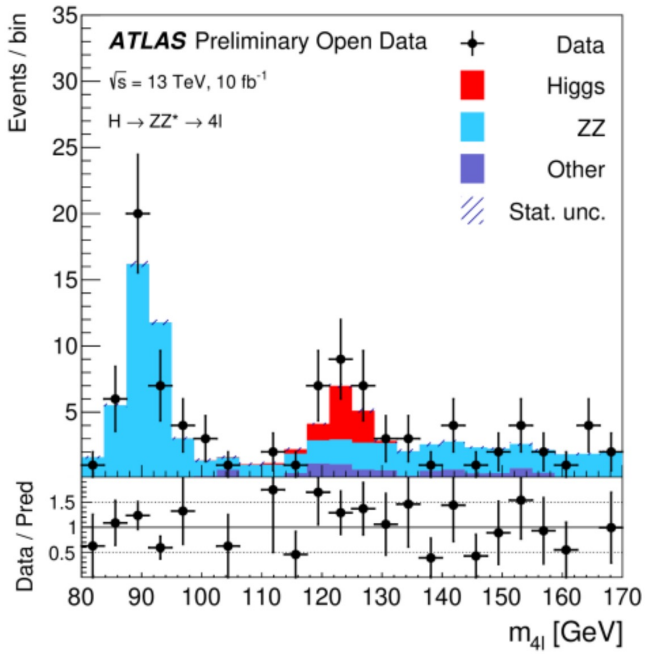
Open Science

The ATLAS experiment

We provide these proton–proton collision datasets within a comprehensive educational package to ensure usability at various levels, and for different educational objectives.



- Students get to analyse the data themselves to search for particles such as the Higgs, or New Physics!

- Using example code and an existing framework, advanced students can learn various analysis techniques, programming skills and machine learning, and gain an understanding of statistics and uncertainty.

Open Science

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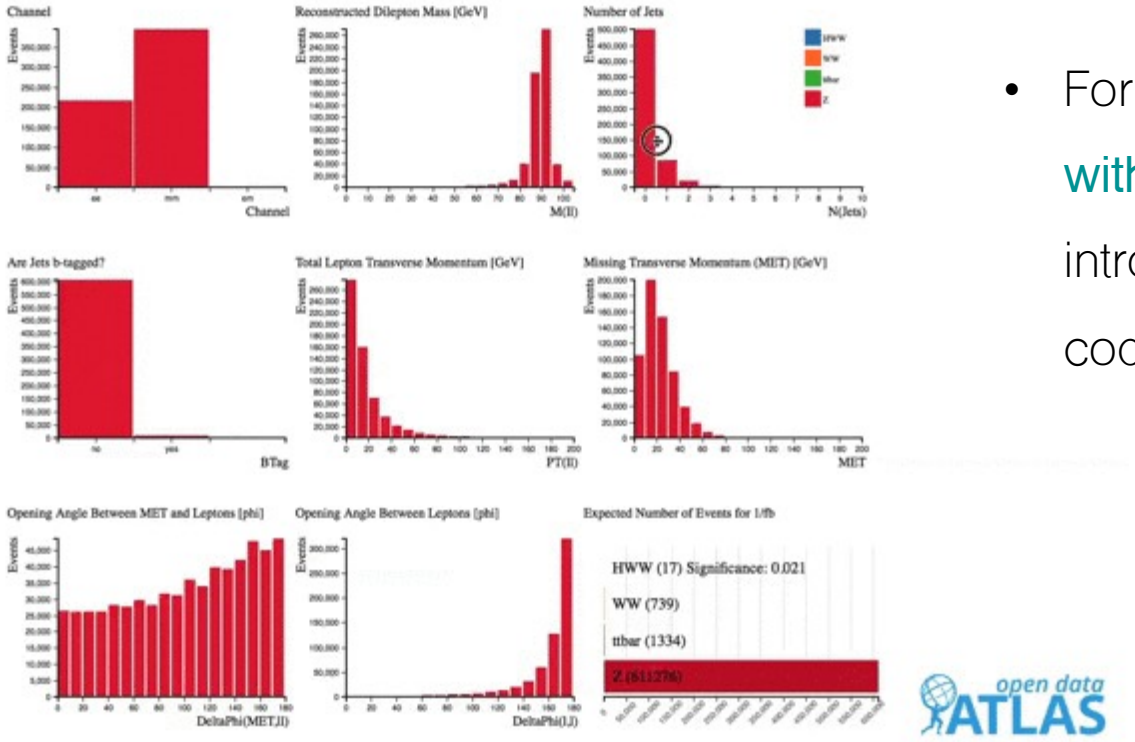

- For less experienced students we provide tools without need for coding, and simple introductory notebooks to give students basic coding and analysis training.