



The Abdus Salam
**International Centre
for Theoretical Physics**
Physics Without Frontiers



PHYSICS WITHOUT FRONTIERS

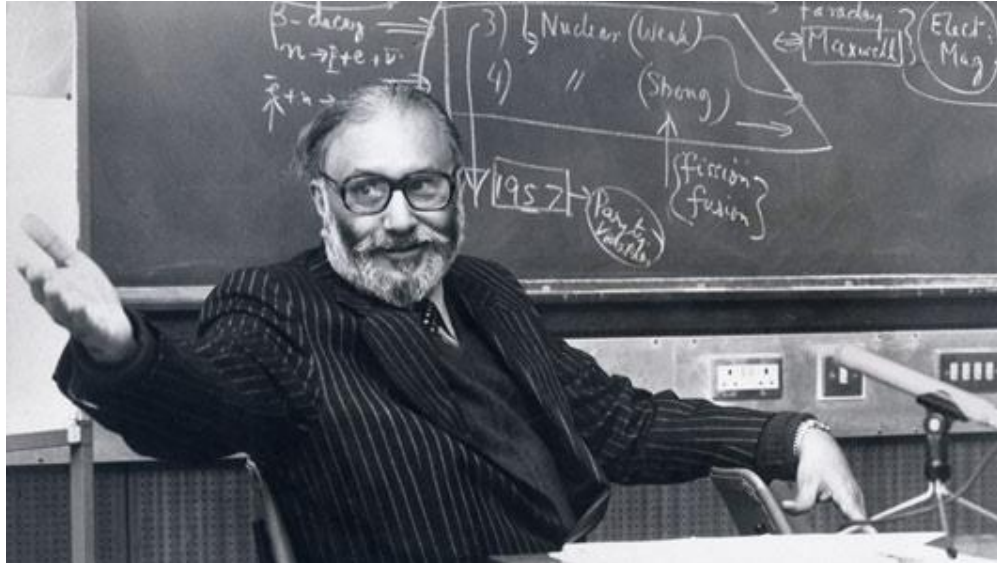
12 November 2025

KATE SHAW, University of Sussex
ATLAS | DUNE

The Abdus Salam International Centre for
Theoretical Physics (ICTP)



Introduction to the ICTP



The **Abdus Salam International Centre for Theoretical Physics (ICTP)** was founded in 1964 by Abdus Salam, in Trieste in the North-East of Italy who served as its director until 1993.

Salam also founded the [*Third World Academy of Sciences \(TWAS\)*](#)



ICTP is a focal point of **cooperation** between the North and South, aiming to support scientists from the South contribute to state-of-the-art research in **physics and mathematics**.

Introduction to the ICTP



ICTP organises more than 60 conferences and workshops, with 4000 – 5000 scientists from around 130 nations each year.

ICTP is an institute with 6 main areas of research:

- High energy, cosmology and astro-particle physics
- Condensed matter physics
- Mathematics
- Earth sciences
- Applied physics
- Quantative life sciences

Programmes include

- ICTP diploma: a pre PhD one year course with project
- Master programmes, including medical physics
- Sandwich (STEP) programmes
- Laboratory Opportunities
- Scientific Calander with many workshops and conferences

Sustainable Development

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

Investment into Science Research and development has been identified as an **accelerator** to achieve the **SDGs**

8/10 countries are devoting < 1% GDP to research. To reach SDG by 2030 countries will need to invest more into research and innovation



Sustainable Development

Figure 1.1: Global shares of GDP, research spending, researchers, publications and patents for the G20, 2014 and 2018 or closest years (%)

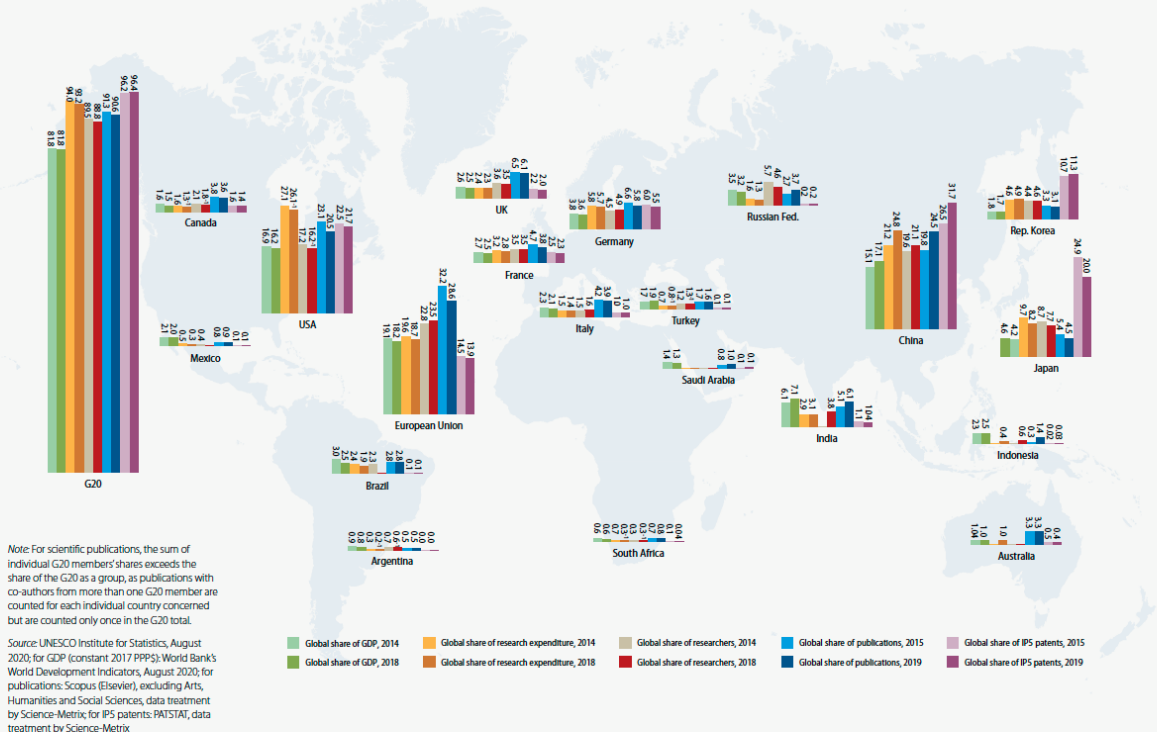
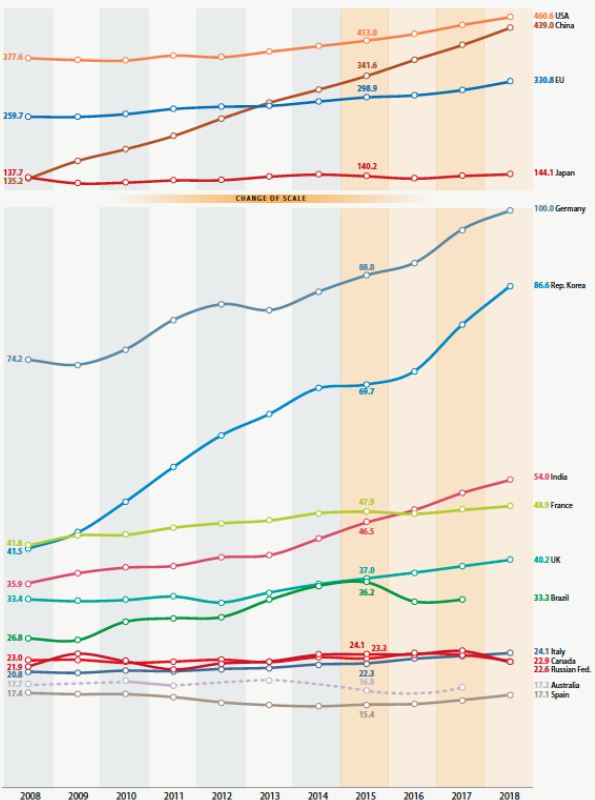


Figure 1.8: Trends in research expenditure

Top 15 countries for gross domestic expenditure on R&D (GERD), 2008–2018
In PPP\$ billions (constant 2005 prices)



Note: Germany, France, Italy, Spain and the UK are also included in the value for the European Union (EU).

Sustainable Development

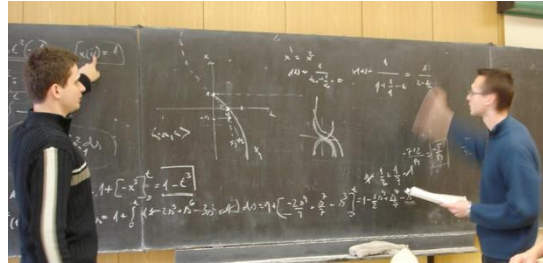
The need to solve environmental and developmental problems requires **scientists** and **scientific** and educational institutions

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, improving scientific literacy



Sustainable Development



Fundamental Science



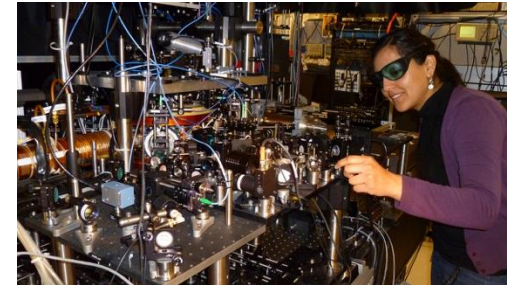
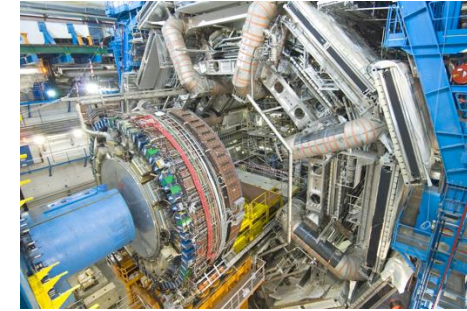
Applied Science



**Technology, Engineering and
Innovation**



Sustainable Development



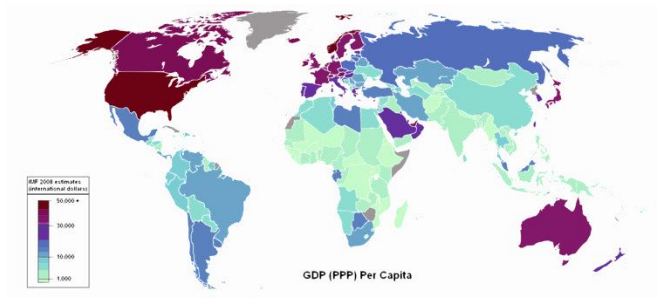
Sustainable Development

How can science address global challenges and achieve the SDG by 2030

- Science brings technological, economic and educational development
- **Open Science** and **Open Data** are a vital part of the pathway towards the SDG goals, and important for accessibility to science
- **Scientific literacy** across the world is necessary for all to benefit from science
- **International cooperation** is another important pathway, must be encouraged especially between countries in Global South
- **Science must be for all**, access to science and scientific training is vital, we must increase the access to careers in research to students from low-income countries

Open Science

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.

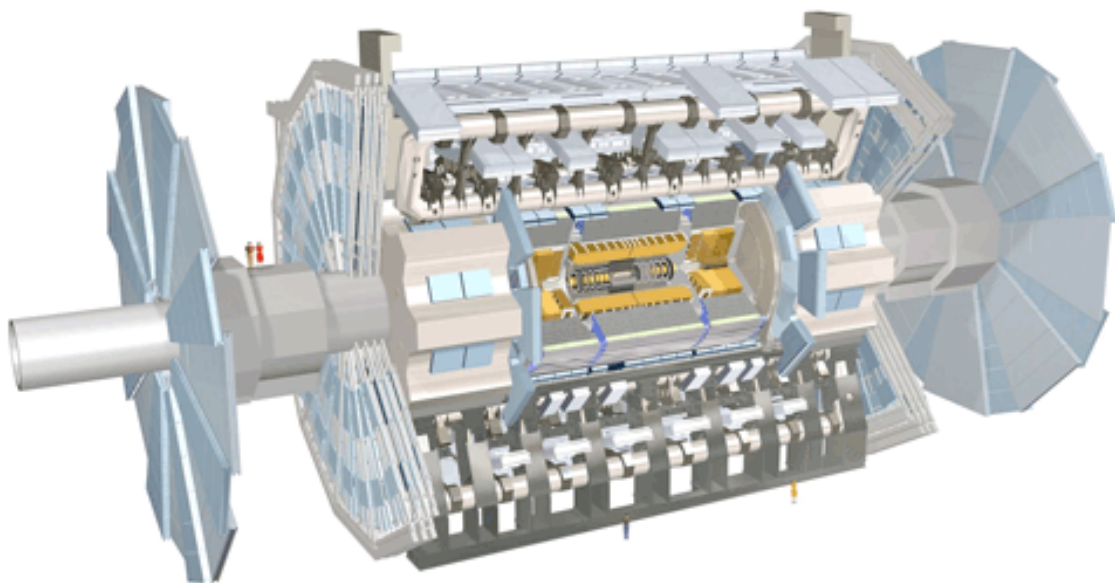


Helps to support science being connected to **societal needs** for people in aspects such as health, agriculture, technology, and sustainable development.

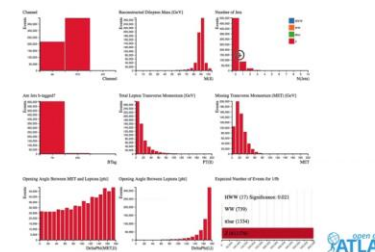
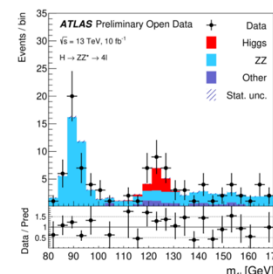
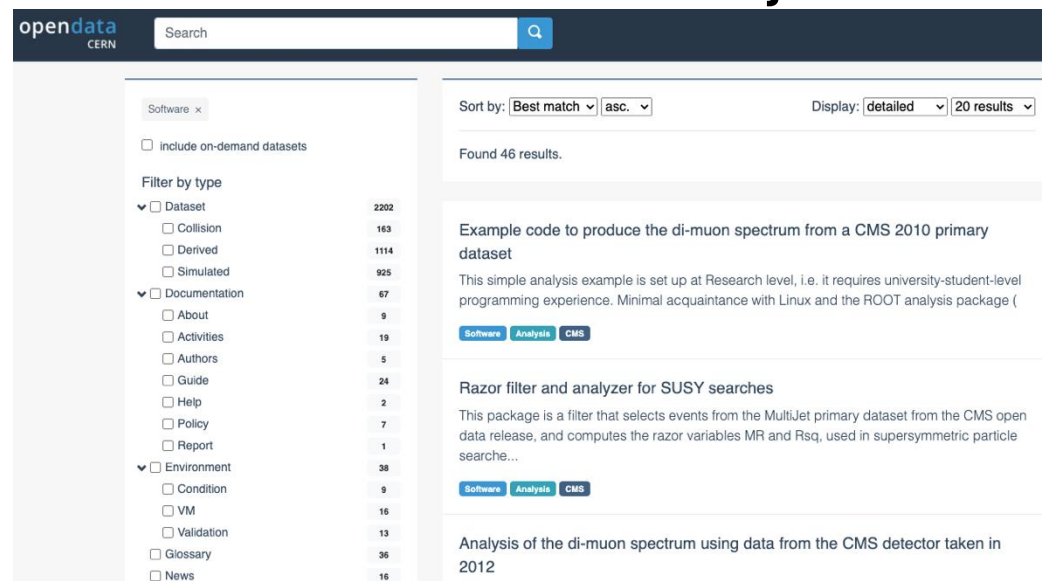
Some issues are local and need local experts with access to resources, some are **global** requiring international cooperation.

ATLAS OPEN DATA

ATLAS provides proton-proton collision datasets within a comprehensive educational package to ensure usability at various levels, and for different educational objectives.



<http://opendata.atlas.cern/>



Physics For All

Internationally, richer countries have the lions share of scientists, funding, supportive scientific environments

- many countries lack resources and their universities lack investment
- many scientists do not have the same access to funding and governmental support as others
- many students and young people lack exposure, access and opportunity
- **This costs us valuable scientists!**

Dr Wafaa Khater, Birzeit University, Palestinian Territories.



- Lacks time for research
- No access to research grants
- No funding to travel to conferences to present results and meet new collaborators

ICTP Physics Without Frontiers

ICTP Physics Without Frontiers works to teach, train and motivate physics and mathematics university students worldwide **to help build the next generation of scientists**. Each project is unique, developed with the country's specific needs in mind.

- **Inspire** and **motivate** the next generation of physicists
- **Train** and **educate** those with hands-on physics and transferable skills
- **Collaborate**, providing stimulating networking environments
- **Mentor** students onto further study and provide career advice



ICTP Physics Without Frontiers

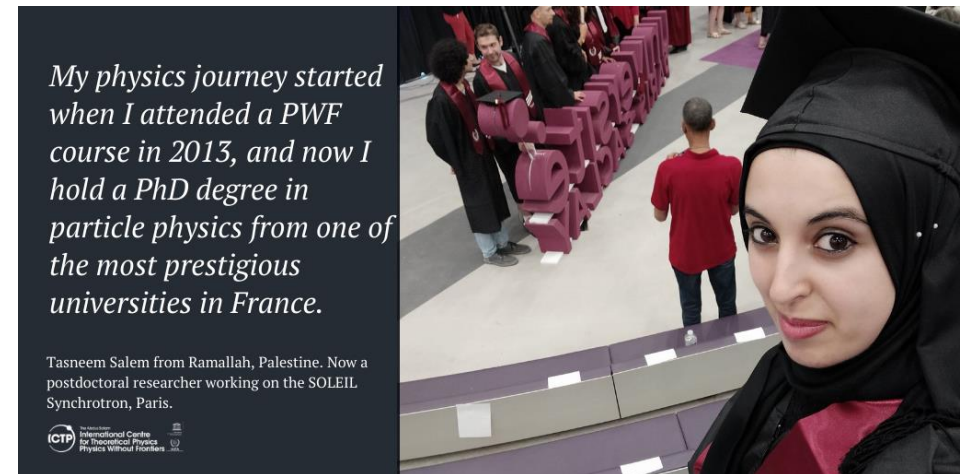
Aims of the Project

To **expose and introduce** new ideas in physics to undergraduate and master students, provide courses and training in key analysis and transferable skills

To identify **top students**, provide **mentoring** and support for further study and career

To **connect with scientists**, support them with international opportunities and collaboration

Bring awareness to the university and **policy makers** to the importance of supporting physics departments and ultimately research



ICTP Physics Without Frontiers

Who organises PWF projects: PWF Volunteer network

who are PhD students, postdoctoral researchers, and lecturers from all over the world, who are passionate about promoting physics and mathematics and supporting young people.

The **Physics Without Frontiers Volunteer Network** is composed of more than 100 passionate scientists primarily from the Global South.

Who are PWF projects organised for?

Our audience is undergraduate and master students, currently studying physics and looking for training and exposure to research topics!

What inspired you to take up your field in physics, do a masters or PhD?

An inspiring teacher or lecturer, an opportunity at a conference or workshop, a seminar or meeting a scientist?



PWF volunteer, Ibrahima Bah
Assistant professor, John Hopkins
University.

Building the next generation of scientists



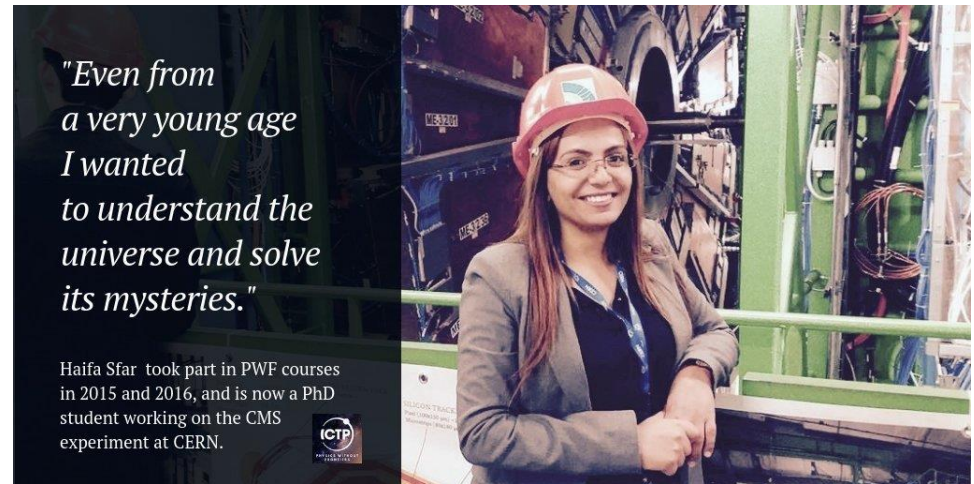
'Thanks for the opportunity for participating in the PWF Senegal. I had a fantastic time! I am looking forward to doing one again anywhere, I will be happy to volunteer as opportunities arise.'

Building the next generation of scientists

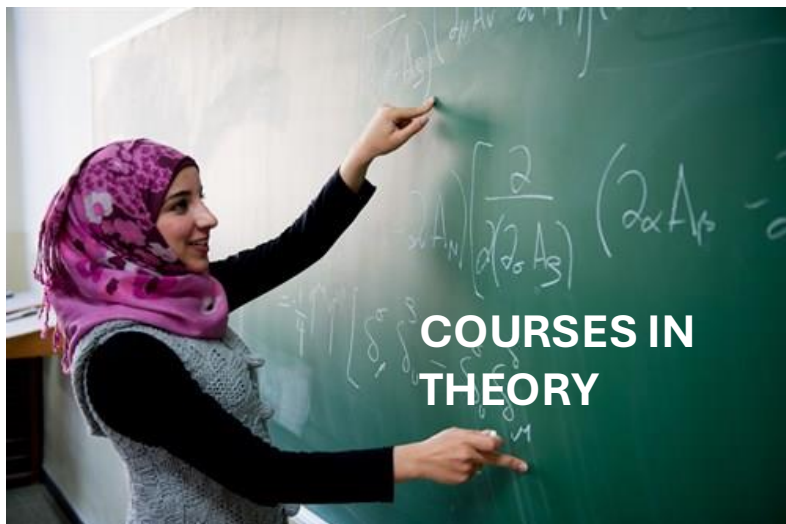
Train: Each Physics Without Frontiers project is unique, combining activities such as hands-on training, lecturing and teaching, mentoring and networking, developed with a country's specific needs in mind.

Mentor: A careers and opportunities session is always included to advertise opportunities, provide advice on CV, applications, interview technique, in academic and also industry. Students can be mentored onto further study

Impact: In addition outreach events for the public or secondary school students may be organised, public and policy maker events, interactions with industry and with the media may also be incorporated.



PWF Projects



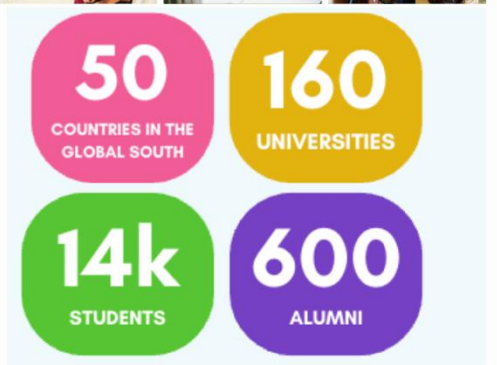
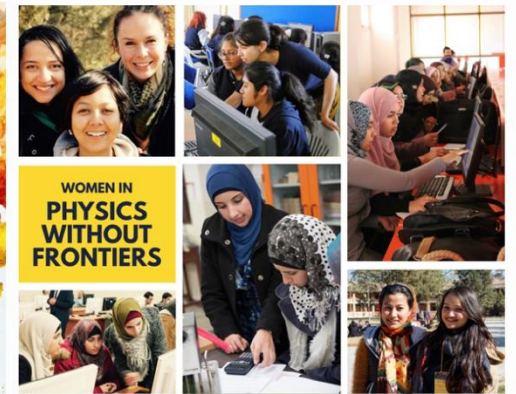
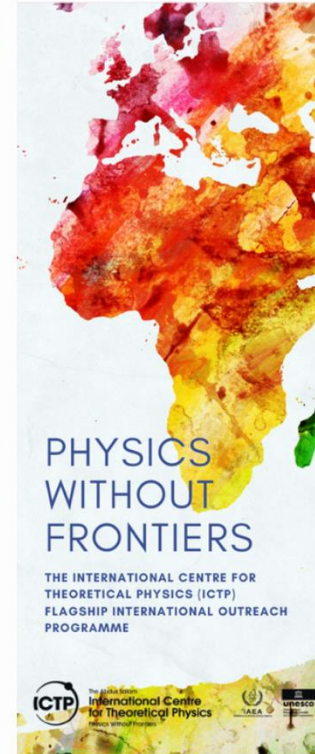
PWF Projects

- We work to bring physics to each corner of the Globe
- Focus on
 - Low-income countries
 - Science and technology lagging countries
 - Countries in conflict or political turmoil
 - Students in under-represented groups
 - Women and girls
 - Students in rural or remote areas
 - Under-represented ethnicities

Lesotho	Mongolia	Cuba
Afghanistan	Peru	Uruguay
Mexico	Palestine	Morocco
Zimbabwe	Syria	Ethiopia
Pakistan	Bolivia	Tunisia
Nigeria	Ghana	Bhutan
Cameroon	Iran	Kurdistan Region
Nepal	Senegal	in Iraq
Argentina	Colombia	Tanzania
Vietnam	Sri Lanka	Malaysia
Lebanon	Philippines	Jamaica
Senegal	Ecuador	Barbados
Honduras	South Africa	Guatemala
Libya	Sudan	Malawi
Trinidad and Tobago	Venezuela	Eswatini
Bangladesh	Chile	Namibia
Costa Rica	Brazil	Togo
	Zimbabwe	Kuwait

ICTP Physics Without Frontiers

We work with over **50 countries** worldwide, and run around 25 PWF projects around the world every year, in all areas of physics



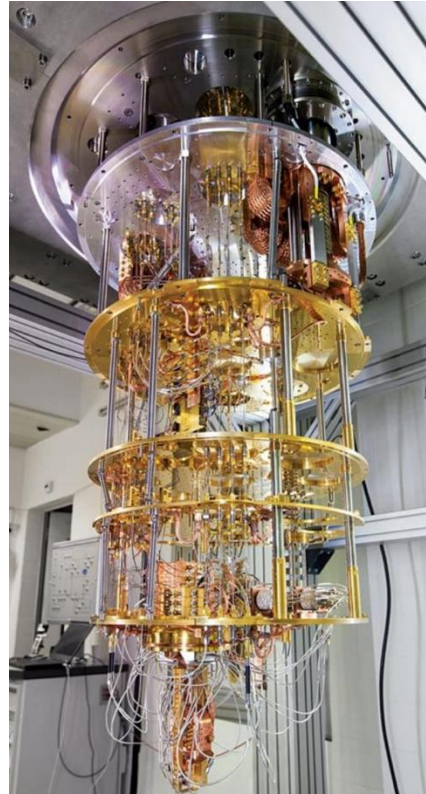
PWF Zimbabwe: Synchrotron Physics and X-ray Imaging Techniques Roadshow



PWF Roadshow to **four universities in Zimbabwe** teaching Xray and synchrotron physics to increase awareness to students on synchrotrons and their science applications.

Kudakwashe Jakata (The Diamond Light Source, UK)
Hilary Masenda (University of the Witwatersrand)
Gideon Chinamatira (University of the Witwatersrand)

PWF Lesotho: School on Quantum Computing



Annual schools on **Quantum Computing**: Intensive training, brilliant feedback from students. One student successfully enrolled with ICTP **EAIFR** for postgraduate degree

ICTP Physics Without Frontiers



We work to bring physics to each corner of the Globe, with focus on:

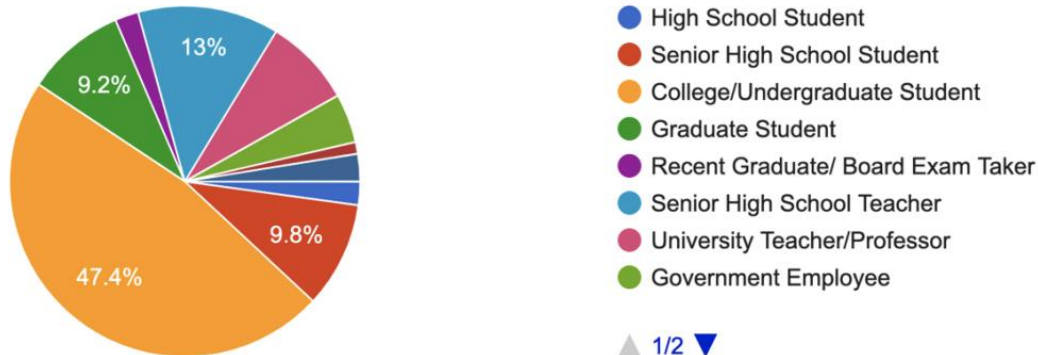
- **Economic** Frontiers: Low income & science & technology lagging countries
- **Social** Frontiers: Women and Girls, cultural frontiers
- **Geographical** Frontiers: Rural and remote areas
- **Sociopolitical** Frontiers: under represented ethnicities and conflict regions or political turmoil

Under-represented group in rural or remote areas

Physics Without Frontiers works with the Department of Physics of Central Mindanao University, runs Physics Meetup, a monthly online physics lectures with well known scientists

We support ~150 students with internet dongles that have little or no access to internet.

Monthly:
500 registered participants over zoom
1000+ watch over Facebook Live



▲ 1/2 ▼



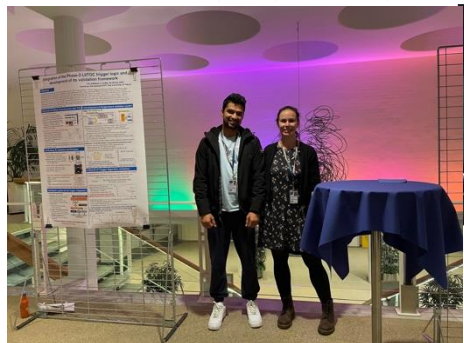
Under-represented group in rural or remote areas



Yarlag Prasad Kandel: ICTP Spring School Complex Systems 2015.



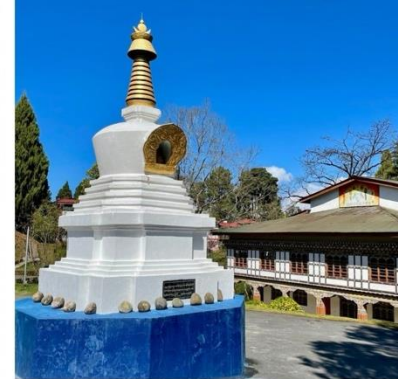
Santosh Parajuli: CERN Summer School 2016
First Nepalese Master thesis in particle physics, ATLAS experiment at CERN (with ICTP and Suyog)
Accepted into PhD particle physics US.



Abhish Thakur: CERN Summer School 2016



Under-represented group in rural or remote areas



PHYSICS WITHOUT FRONTIERS: BHUTAN
Workshop in Symmetries, Data Science, and AI for Physicists
25th - 29th March 2024
Lecturer Theater II, Sherubtse College, Kanglung, Trashigang.
Visit: indico.ictp.it/event/10657/

LOCAL COORDINATOR:
Man Bahadur Ghalley, Sherubtse College, Royal University of Bhutan

SPEAKERS:
Prof. Andrea Banfi, University of Sussex, UK
Dr. Kate Shaw, ICTP, Italy, & University of Sussex, UK
Dr. Mick Taylor, University of Sussex, UK

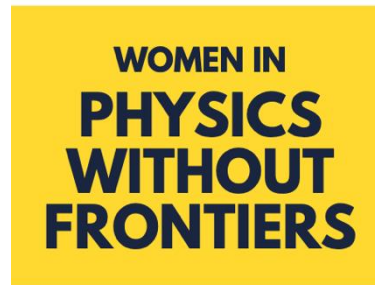
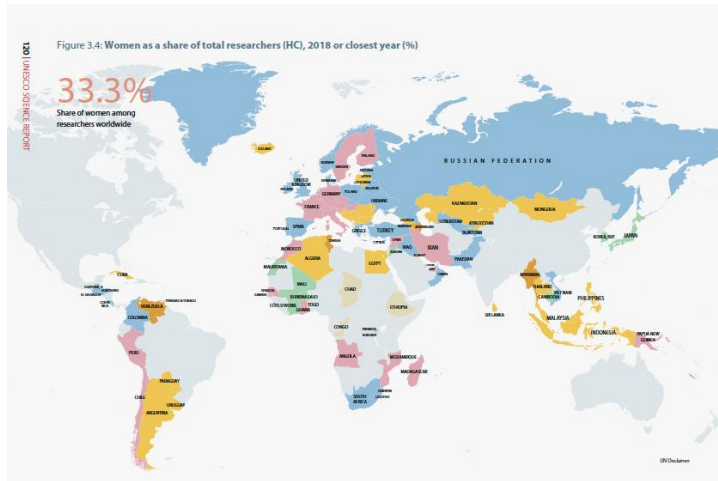
Logos for US, DISCnet, ICTP, and other partners are displayed at the bottom.



Under-represented groups: Women and girls

Women accounted for one in three (33%) researchers in 2018

The participation of women and other underrepresented groups should be actively encouraged in order to remediate inequalities



Under-represented groups: Women and girls

Urgent need to address the declining number of women studying physics in South Africa.

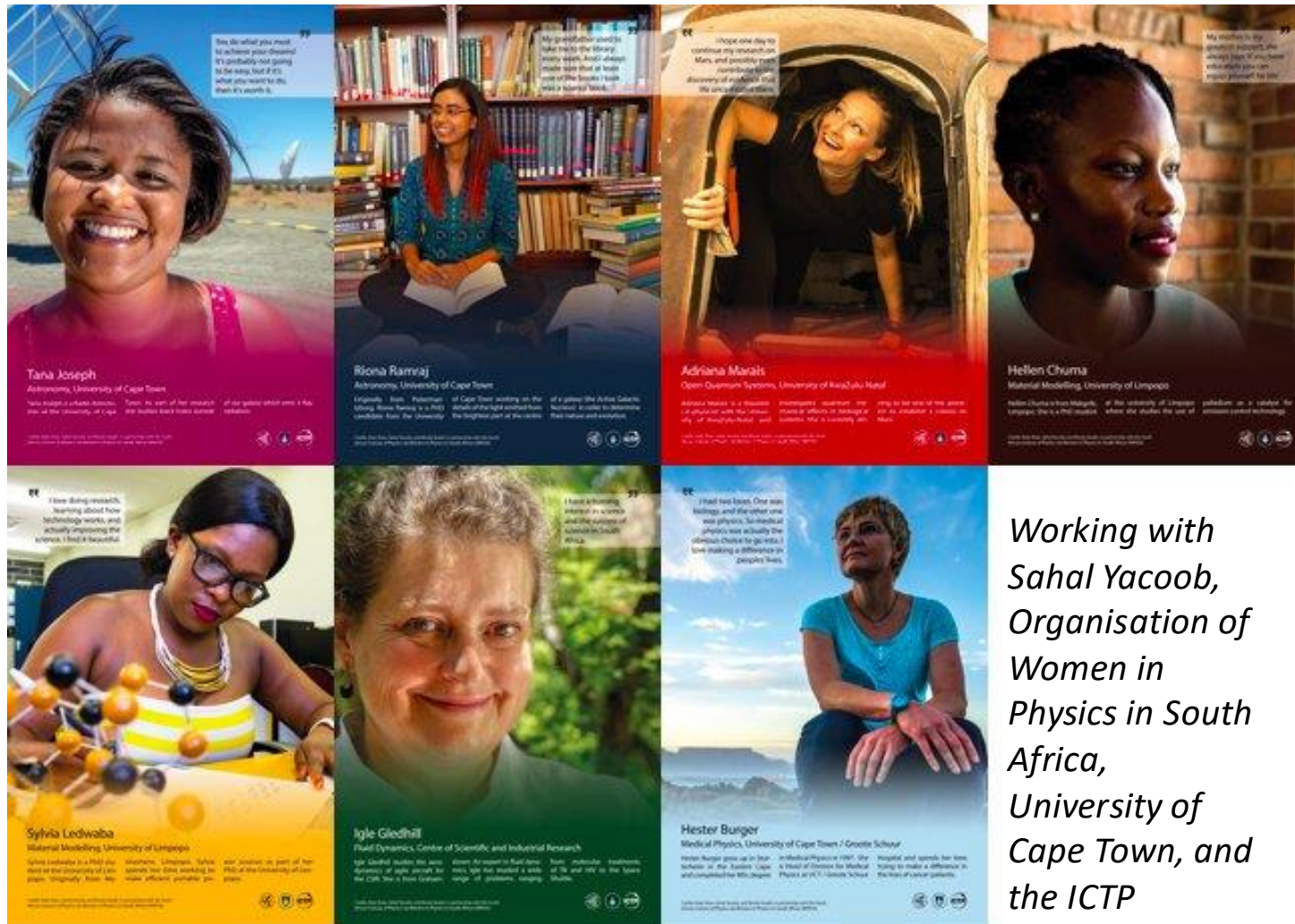
13% STEM graduates are women

Project to motivate and inspire secondary school children

Posters of women in Physics, with inspiration quotes

Displayed in high schools and science events throughout South Africa

Role models and imagery are vital



*Working with
Sahal Yacoob,
Organisation of
Women in
Physics in South
Africa,
University of
Cape Town, and
the ICTP*

Under-represented groups: Women and girls

More women study physics than men in Palestine, and many countries in the Arab World

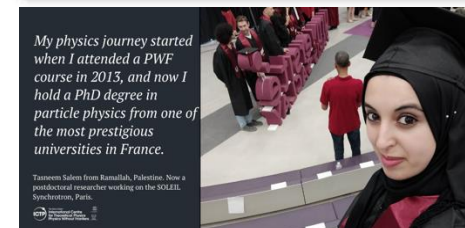
We documented through photography and interviews the experience of Palestinian Women in Physics

The Students were inspirational, and we learn so much!



Photoessay on Women in Physics in the Palestinian Territories

<https://www.scidev.net/global/multimedia/women-physics-palestinian-territories-photos/>



Countries in conflict or political turmoil



Countries in conflict or political turmoil

Some countries have experienced violent conflict and insecurity in recent years

- For example: Afghanistan, Iraq, Yemen, Syria, Venezuela, Mali, Palestine, South Sudan, Central African republic
- Some of these countries had strong science and engineering sections before conflict
- When a **conflict ends** the country will have **lost a generation of trained scientists**, and the next generation who would have been trained
- Without a strong science sector to support economic growth development, along with other sectors, few opportunities will arise and poverty will persist.

Countries in conflict or political turmoil



Annual Schools 2018, 2019, Online Conference 2024, 2025

Working with governments and UNESCO to develop BSc and MSc courses

With no MSc, PWF works with IASBS and Iranian universities to provide now 40 MSc scholarships for students

We are trying to support students onto further study

Countries in conflict or political turmoil



**PHYSICS WITHOUT FRONTIERS
AFGHANISTAN**

**AFGHAN PHYSICS STUDENTS
CONFERENCE 2025**
17-18 November 2025

Register: indico.ictp.it/event/11010/
Deadline 31 October 2025

This two day online conference will bring together Afghan physics students from around the world along with international scientists who support the students' education and research.

Day one invites all participants to join to hear the presentations from the Afghan MSc and PhD student highlighting their research and physics studies. Day two invites only the Afghan students to training in careers and opportunities in physics, and discussion sessions on non academic pathways, industry links, and skill development.

ORGANISING COMMITTEE
Sharif Hussainyar, University Medical Center Hamburg-Eppendorf, Germany
Baktash Amini, University of Freiburg, Germany
Ahmad Sajad Nazari, Kabul University, Afghanistan
Zainab Nazari, European Brain Research Institute (EBRI), Italy
Farsila Payandi, IASBS, Iran
Humaira Yaqoti, IASBS, Iran
Kate Shaw, ICTP, Italy, & University of Sussex, UK

ICTP The World's largest International Centre for Theoretical Physics
IAEA UNESCO

Go to day ▾

Monday, 17 November 2025

- 09:00 - 12:45 Morning Session
- 09:00 **Welcome Address 15'**
Speakers: Dr. Kate Shaw (ICTP), Mr. Sharif Hussainyar (University Medical Center Hamburg-Eppendorf), Germany)
- 09:15 **Welcome from PWF Afghanistan 10'**
Speakers: Baktash Amini, Zainab Nazari
- 09:25 **Introduction to ICTP 20'**
- 09:45 **Welcome Remarks 15'**
- 10:00 **Introduction to EBRI 20'**
- 10:20 **Medical Physics 20'**
Speaker: Mohammad Yasin Mohammadi
- 10:40 **Afghan Womens Online University 20'**
Speaker: Dr. Fawziya Popal
- 11:00 **An Introduction to DESY 20'**
- 11:30 **An Introduction to CERN 20'**
Speaker: Charlotte Warakaulle (CERN)
- 12:00 **Lunch Break 45'**
- 12:45 - 14:00 Student Talks

Tuesday, 18 November 2025

- 10:00 - 12:45 Morning Session
- Convenor: Sharif Hussainyar
- 10:00 **Introduction 10'**
Speaker: Sharif Hussainyar
- 10:10 **Afghan Women Physics Academy 20'**
Speaker: Farsila Payanda
- 10:30 **Summer schools Experience at CERN and ICTP 15'**
Speaker: Humaira Yaghoti
- 10:45 **Current Research in Germany 20'**
Speaker: Jawad Ahamadi
- 11:05 **Surrey Technology Centre 20'**
Speaker: Shakardokht Jafari
- 11:25 **Break 5'**
- 11:30 **CV Writing Workshop 30'**
Speaker: Sharif Hussainyar
- 12:00 **Lunch 45'**
- 12:45 - 13:30 Student Talks
- 13:30 - 14:00 Closing Session
- 13:30 **Introduction to the Perimeter Institute 20'**
Speaker: Dan Wohns (Perimeter Institute)
- 13:50 **Final Remarks, Q&A, Close 10'**
Speakers: Sharif Hussainyar, Kate Shaw



<https://indico.ictp.it/event/11202/>

Countries in conflict or political turmoil

Venezuela

Socio-economic and political instability that has propelled more than five million Venezuelans, almost 20% of the population, out of the country, as of 2020 due to instability.

Major Venezuelan universities have lost around 45% of their academic staff

PWF BrainGain Team supported 14 fellows in 2020 and 2021, to help keep talent in the country!

2022 the team organise an intensive two-week Physics School to fight back the flight of physics students out of the classrooms.



Organizing committee: Gabriel Abellán (UCV), Hermann Albrecht (USB), Nelsón Bolívar (Bariloche, UCV), Mario Cosenza (Yachay), José Fermín (LUZ), Rolando Gaitán (UC), José Antonio López (UCV), Kevin Ng (Northeastern), Rafael Torrealba (UCLA), Juan Villegas (ULA).

Project coordinators: Ismaro Bonalde (ACFIMAN), Reina Camacho Toro (CNRS-LPNHE), Anamaria Font (UCV), Arturo Sánchez (Creative Commons Venezuela)



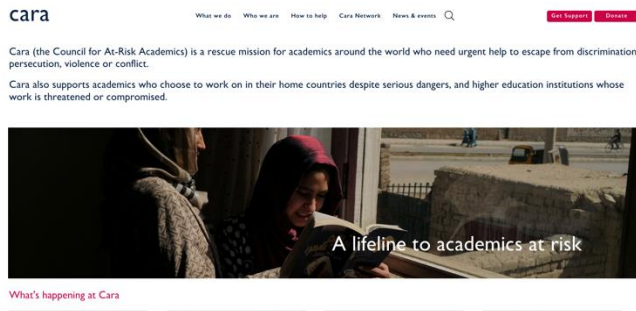
Countries in conflict or political turmoil

Refugees flee conflict or economic turmoil, a number of whom are scientists, (~1600 displaced Scientists from Iraq alone)

If they remain in refugee camps their knowledge and skills go untapped and they may lose their career

Host nations would do well to identify and support high-achieving individuals rapidly and integrate them in universities, research institutions, teaching hospitals and private enterprises.

Allows one to live in dignity, many of them will return to their countries of origin where they will help rebuild their societies



All countries have a responsibility to provide sustained support to our colleagues



TWAS: The World Academy of Science
<https://twas.org/article/refugee-scientists-way-forward>

"The scientific community has too often not been proactive in taking care of colleagues arriving from war-torn areas" TWAS

Palestine & Gaza



يُنظِّم من كرسى اليونسكو في الرياضيات والفيزياء النظرية في جامعة بيرزيت وبالتعاون مع مشروع أفق بلا حدود في المركز العلمي للبحوث النظرية في إقطاعيا ندعوتكم لحضور محاضرة عن:

الأمواج الجاذبية
Some aspects of gravitational waves searches above 10 kHz

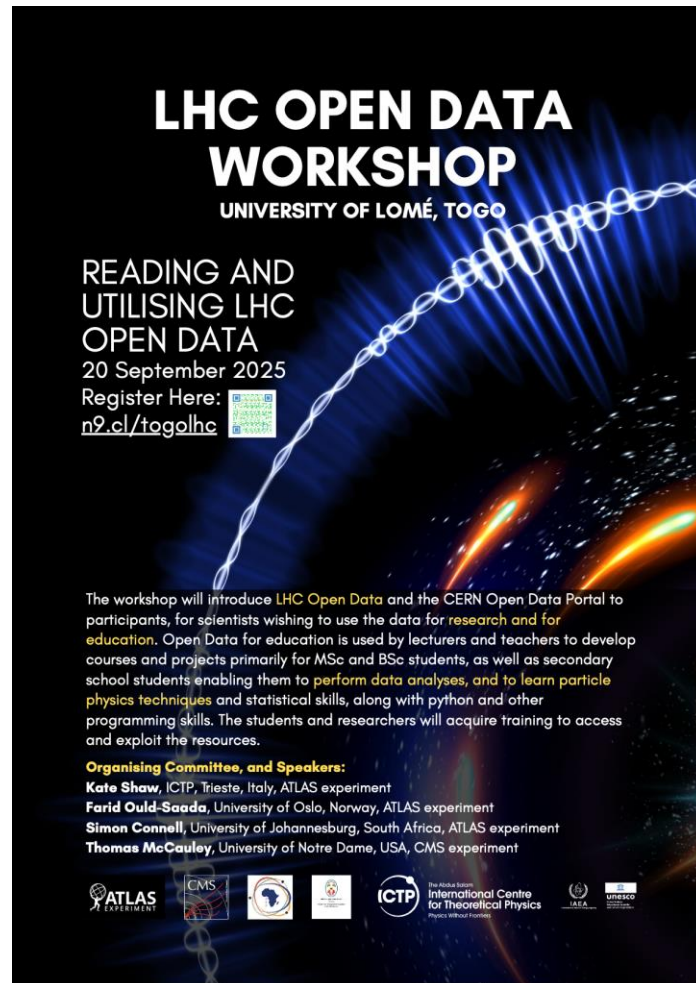
يقدمها البروفيسور
Killian Martineau

وذلك يوم الأربعاء 29 تشرين أول 2025، الساعة الثانية بعد الظهر



BRIZIT UNIVERSITY

LHC OPEN DATA WORKSHOP



LHC OPEN DATA WORKSHOP
UNIVERSITY OF LOMÉ, TOGO

READING AND UTILISING LHC OPEN DATA
20 September 2025
Register Here: n9.cl/togolhc

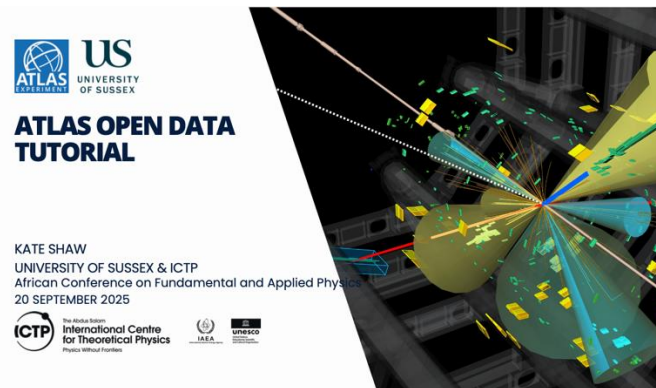
The workshop will introduce LHC Open Data and the CERN Open Data Portal to participants, for scientists wishing to use the data for research and for education. Open Data for education is used by lecturers and teachers to develop courses and projects primarily for MSc and BSc students, as well as secondary school students enabling them to perform data analyses, and to learn particle physics techniques and statistical skills, along with python and other programming skills. The students and researchers will acquire training to access and exploit the resources.

Organising Committee, and Speakers:
Kate Shaw, ICTP, Trieste, Italy, ATLAS experiment
Farid Ould-Saada, University of Oslo, Norway, ATLAS experiment
Simon Connell, University of Johannesburg, South Africa, ATLAS experiment
Thomas McCauley, University of Notre Dame, USA, CMS experiment

Logos: ATLAS, CMS, IAEA, UNESCO, ICTP, The African Centre for Theoretical Physics, Physics Without Frontiers

The workshop introduced the LHC Open Data projects and the CERN OPEN DATA Portal to participants, for scientists wishing to use the data for research and for education.

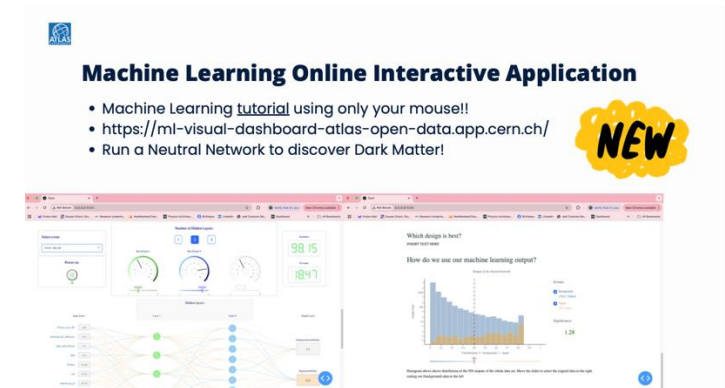
Open Data for education is used by lecturers and teachers to develop courses and projects for MSc and BSc students (or even secondary school students) to perform analyses, learn particle physics techniques, statistical skills, along with python and other programming skills.



ATLAS OPEN DATA TUTORIAL

KATE SHAW
UNIVERSITY OF SUSSEX & ICTP
African Conference on Fundamental and Applied Physics
20 SEPTEMBER 2025

Logos: ATLAS, US, ICTP, The African Centre for Theoretical Physics, Physics Without Frontiers, IAEA, UNESCO



Machine Learning Online Interactive Application

- Machine Learning [tutorial](https://ml-visual-dashboard-atlas-open-data.app.cern.ch/) using only your mouse!!
- <https://ml-visual-dashboard-atlas-open-data.app.cern.ch/>
- Run a Neural Network to discover Dark Matter!

NEW

The poster shows a screenshot of the interactive application interface, which includes a dashboard with various charts and a neural network diagram.

Alumni

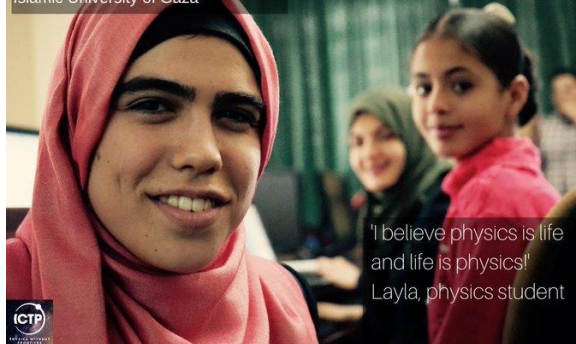


"I love physics and want to make a difference in the world. I am driven to build a career in medical physics, particularly in radiation therapy and imaging for cancer treatment."

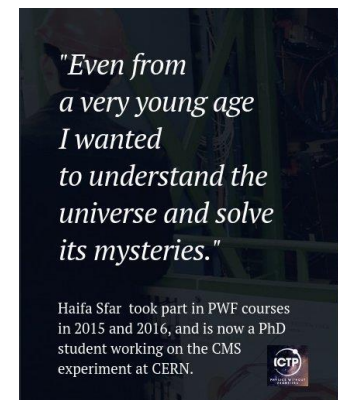
Rami Dhungana K.C took part in the 2018 PWF HEP Winter School, Kathmandu, and is currently a CERN summer student.



Physics Without Frontiers Palestine
Islamic University of Gaza



"I believe physics is life and life is physics!"
Layla, physics student



"Even from a very young age I wanted to understand the universe and solve its mysteries."

Haifa Sfar took part in PWF courses in 2015 and 2016, and is now a PhD student working on the CMS experiment at CERN.



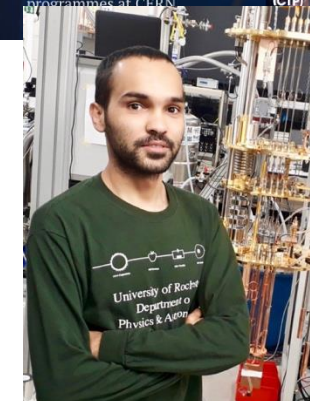
"I had always wanted to know how nature works, and at the PWF workshop, I felt a step closer."

Mahesh Thakuri took part in the 2014 PWF particle physics workshop, Nepal, and is now studying for his masters in physics.



"There are many inspiring women with great contributions in physics and my dream is to become one of them."

Afnan Alostaz took part in the 2017 PWF Palestine program, Islamic University of Gaza, and is now participating in programmes at CERN.



"My aim is to continue research, and to share what I've learned and provide support for those deprived of opportunities and exposure."

Yadav P. Kandel took part in the 2014 PWF particle physics masterclasses in Nepal, and is currently a graduate research assistant at the University of Rochester, working on quantum computing and quantum information.



Over **650** students have been mentored to further study, MSc, PhD, Postdocs!
Many have become PWF Volunteers!

Get involved

Email us – we work with each team individually k.shaw@ictp.it
pwf@ictp.it

Call for applications: Opens December 2025 – January 2026 for projects 2026-2027

Who applies: The main coordinator of the project who has built a team of PWF volunteers including a local organiser and speakers:

- The local organiser, a lecturer at the university
- A PWF Volunteer who is a speaker and key organiser
- We can help you with your application!

How we fund it – people powered! ICTP PWF partners with the local university/universities who pay for local costs. We can find part funding for travel grants only.



**PHYSICS WITHOUT FRONTIERS
CALL FOR PROPOSALS**

Train and inspire physics and mathematics students in the Global South

ICTP's Physics Without Frontiers works to teach, train, and inspire physics and mathematics university students worldwide, with focus on countries in the Global South, to help build the next generation of scientists.

PWF organises projects working with volunteer scientists from all over the world, who are passionate about promoting physics and mathematics, and training and mentoring students. Each project is unique, and is developed with the country's specific needs in mind.

Deadline: 15 January 2025
Email: pwf@ictp.it
Social Media: [eictpPWF](https://www.facebook.com/eictpPWF)
Learn more & Apply: ictp.it/home/physics-without-frontiers

 The Abdus Salam International Centre for Theoretical Physics
 IAEA
 UNESCO
 60 ICTP 1964-2024

Thank you

PWF Website:

<https://www.ictp.it/physics-without-frontiers.aspx>

Social Media: @ictpPWF

Twitter, Facebook, Instagram, LinkedIn

Mailing list:

Email pwf-subscribe@lists.ictp.it with the title SUBSCRIBE

Email us: pwf@ictp.it

Annual Meeting: 11th December 2025

Annual Call: December 2025-January 2026

Email me: k.shaw@ictp.it

OUR IMPACT

We have worked with **160 universities** in over **50 countries** in the Global South impacting more than **14,000 students** worldwide, organising hundreds of activities and events, and stimulating research environments.

50 COUNTRIES IN THE GLOBAL SOUTH	160 UNIVERSITIES
14k STUDENTS	600 ALUMNI

Over 600 students have been **mentored onto further study**, and are now PhD students, postdocs, & faculty around the world, and many **volunteer** for PWF!

GET INVOLVED

SUBSCRIBE to our PWF Mailing List by sending an email with the subject SUBSCRIBE to pwf-subscribe@lists.ictp.it

FOLLOW us on Social Media **#ictpPWF**

APPLY to our call for proposals: ictp.it/home/a-without-frontiers-apply

JOIN our Annual Meetings.

EMAIL: pwf@ictp.it
CALENDER: tinyurl.com/PWFindico
WEBSITE: ictp.it/home/physics-without-frontiers

PHYSICS WITHOUT FRONTIERS

THE INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS (ICTP) FLAGSHIP INTERNATIONAL OUTREACH PROGRAMME

ICTP The Abdus Salam International Centre for Theoretical Physics

Logo of the Abdus Salam International Centre for Theoretical Physics (ICTP) and the Physics Without Frontiers (PWF) program, featuring a map of Africa and a group photo of students.