Statistics on participation of emerging & developing countries in LHC and other experiments

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Claire David

YORK UNIVERSITÉ UNIVERSITY

Fermilab

What is a developing country?

What is a developing country?

…and an emerging one?

Disclaimer:

What you will see is a physicist

giving a crash course in ‘country tagging’

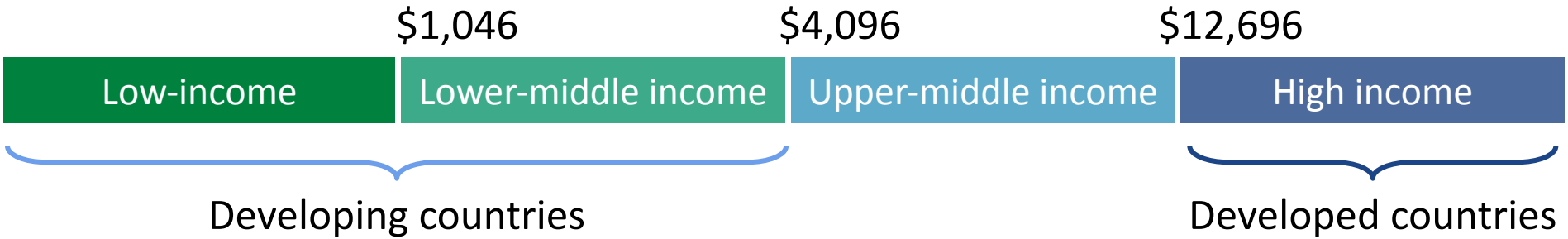
What is a developing country?

"There is no clear agreement" Wikipedia

Low-income country

supersedes 'GDP'

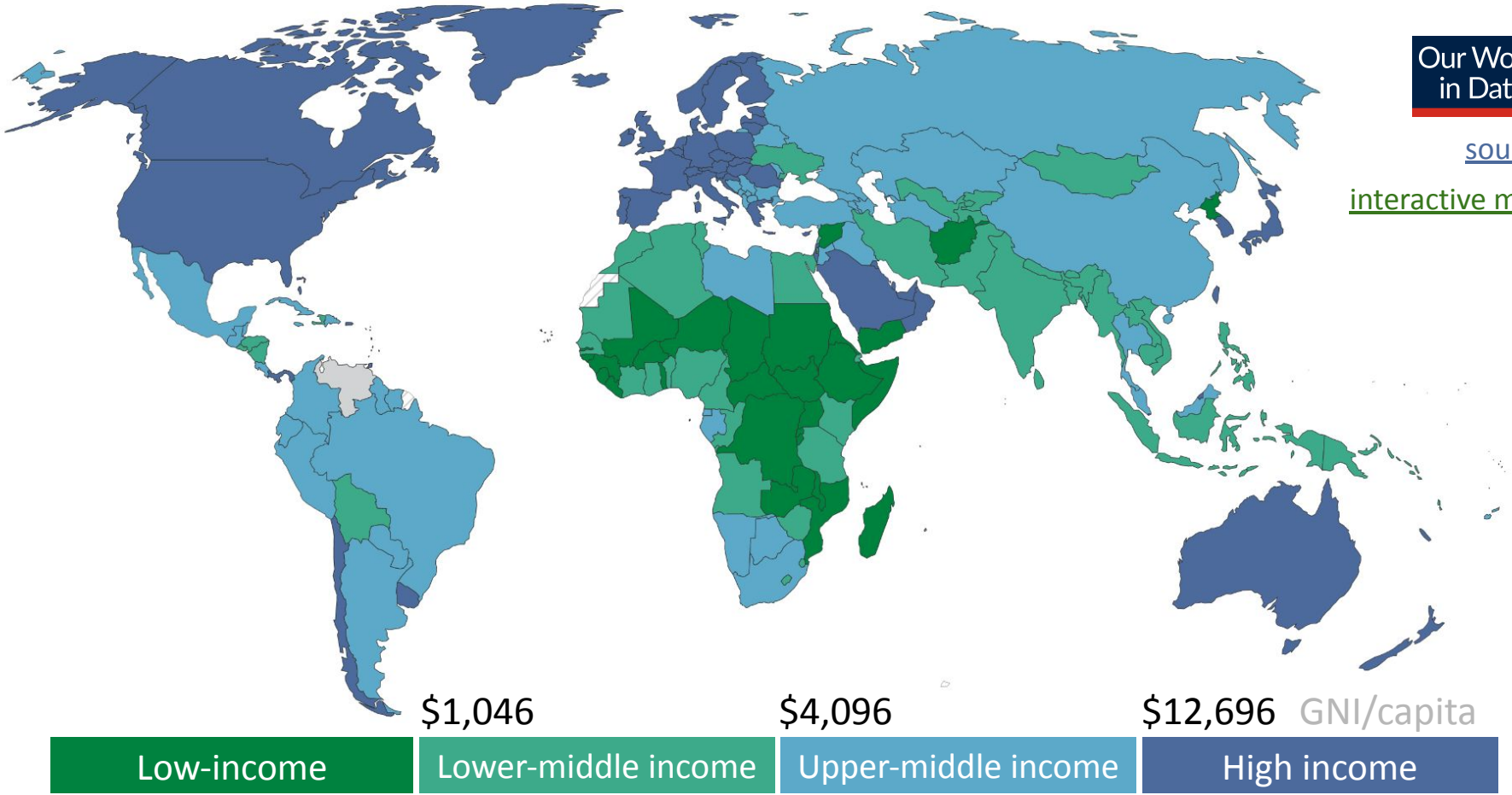
World Bank grouping based on Gross National Income (GNI) per capita:



Third World is not an economic but political term from the Cold War

OUTDATED

World Bank income groups, 2021



Vocabulary (continued)

Emerging countries

- Rapid industrialization in energy, information technology & telecommunication
- Gains on infrastructure
- No longer relying only on agriculture and exportations for economic stability

Emerging markets OUTDATED?

Countries with companies becoming global leaders on the stock market

List varies depending on market index makers

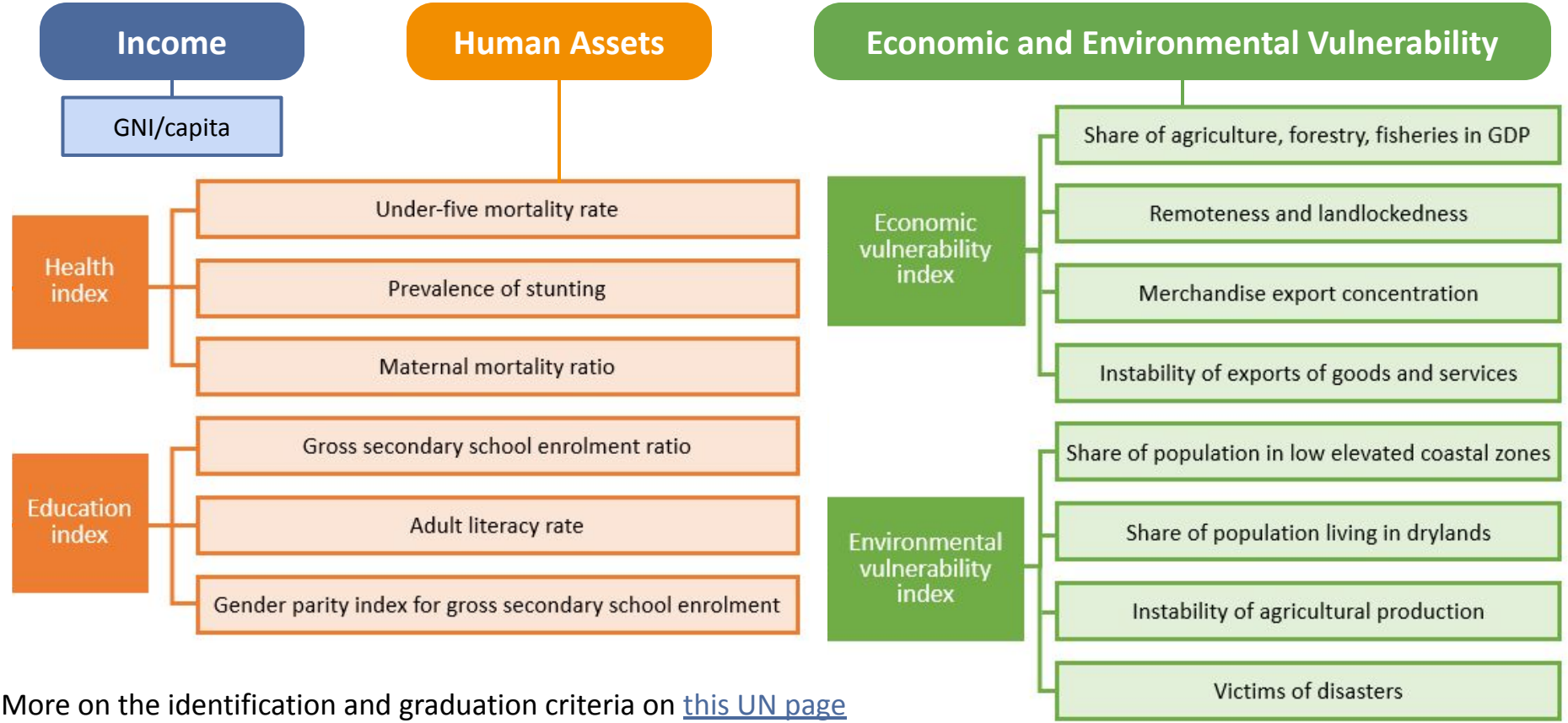
→ Replacement terms: acronyms **BRICs** et al

Least Developed Countries (LDC)

“Fourth World”

Least Developed Countries: Metrics

List reviewed every 3 years by United Nations' Economic and Social Council (ECOSOC) based on:



More on the identification and graduation criteria on this UN page

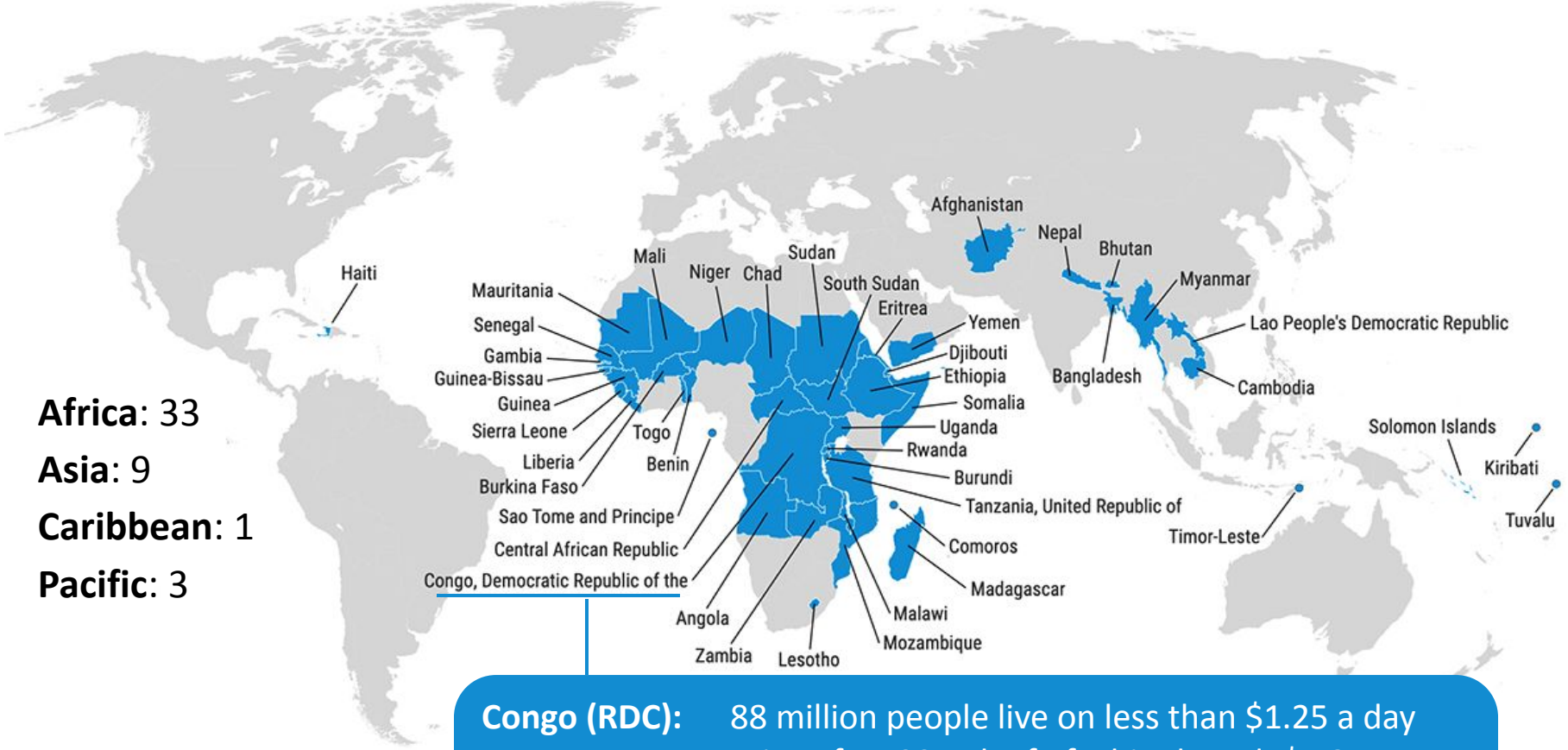
Least Developed Countries: Map

Africa: 33

Asia: 9

Caribbean: 1

Pacific: 3



Congo (RDC): 88 million people live on less than $1.25 a day
Price of a 500 gr loaf of white bread: $1.85

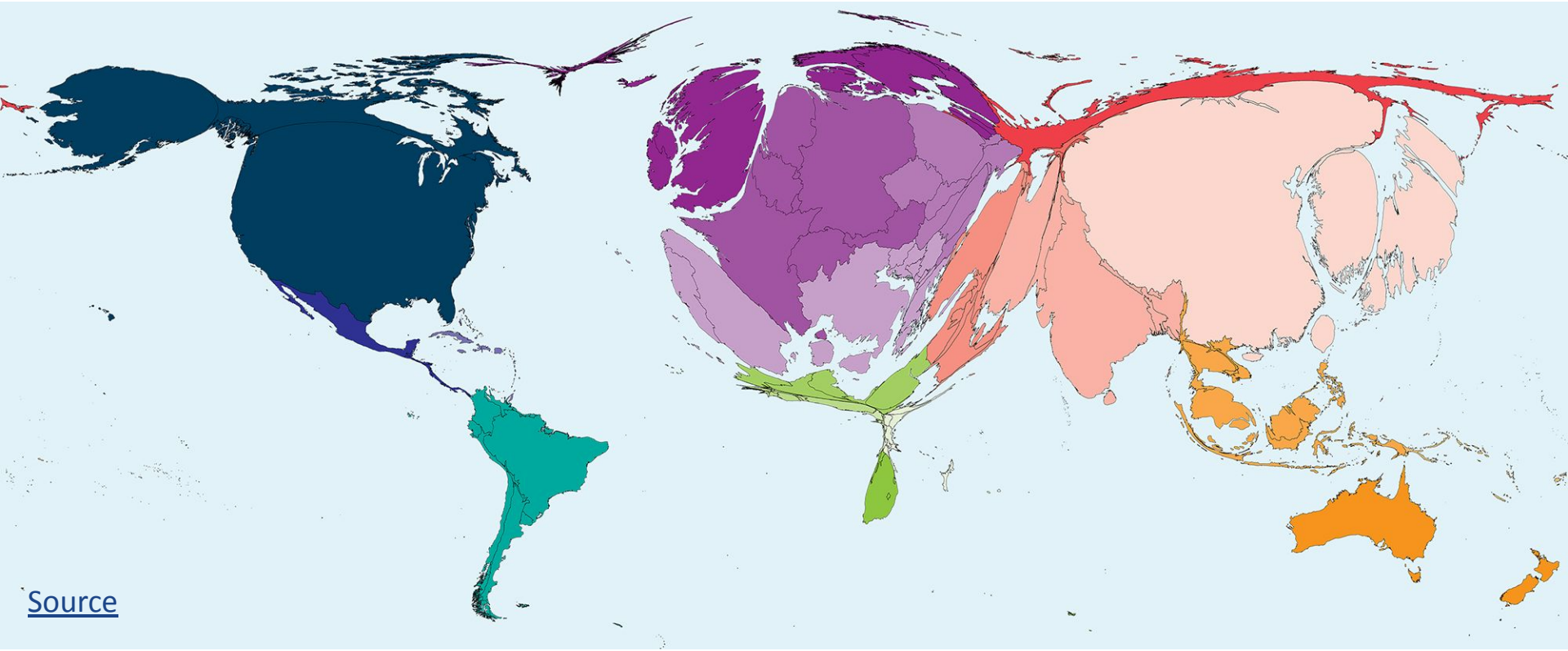
Source: UNCTAD

Developing countries and science

Science Papers Published 2016

Territory size is proportional to the number of scientific journal articles published in that year.

WORLD MAPPER



Source

LHC experiments

ATLAS Collaboration: member nationalities

5900 members

103 nationalities

Afghanistan	India	Romania
Algeria	Indonesia	Russia
Argentina	Iran	Rwanda
Armenia	Iraq	San Marino
Australia	Ireland	Saudi Arabia
Austria	Israel	Senegal
Azerbaijan	Italy	Serbia
Bahrain	Japan	Slovakia
Bangladesh	Kazakhstan	Slovenia
Belarus	Kenya	South Africa
Belgium	Kyrgyzstan	South Korea
Botswana	Latvia	Spain
Brazil	Lebanon	Sri Lanka
Bulgaria	Lithuania	Sudan
Canada	Madagascar	Sweden
Chile	Malawi	Switzerland
China	Malaysia	Syria
Colombia	Malta	Taiwan
Croatia	Mauritania	Thailand
Cuba	Mexico	Türkiye
Cyprus	Mongolia	Turkmenistan
Czech Republic	Montenegro	Ukraine
Denmark	Morocco	UAE
Ecuador	Nepal	Uganda
Egypt	Netherlands	UK
Ethiopia	New Zealand	Uruguay
Finland	North Macedonia	USA
France	Norway	Uzbekistan
Georgia	Pakistan	Venezuela
Germany	Palestine	Vietnam
Ghana	Paraguay	Yemen
Greece	Peru	Zambia
Guatemala	Philippines	Zimbabwe
Hungary	Poland	
Iceland	Portugal	

10 from Least Developed Countries

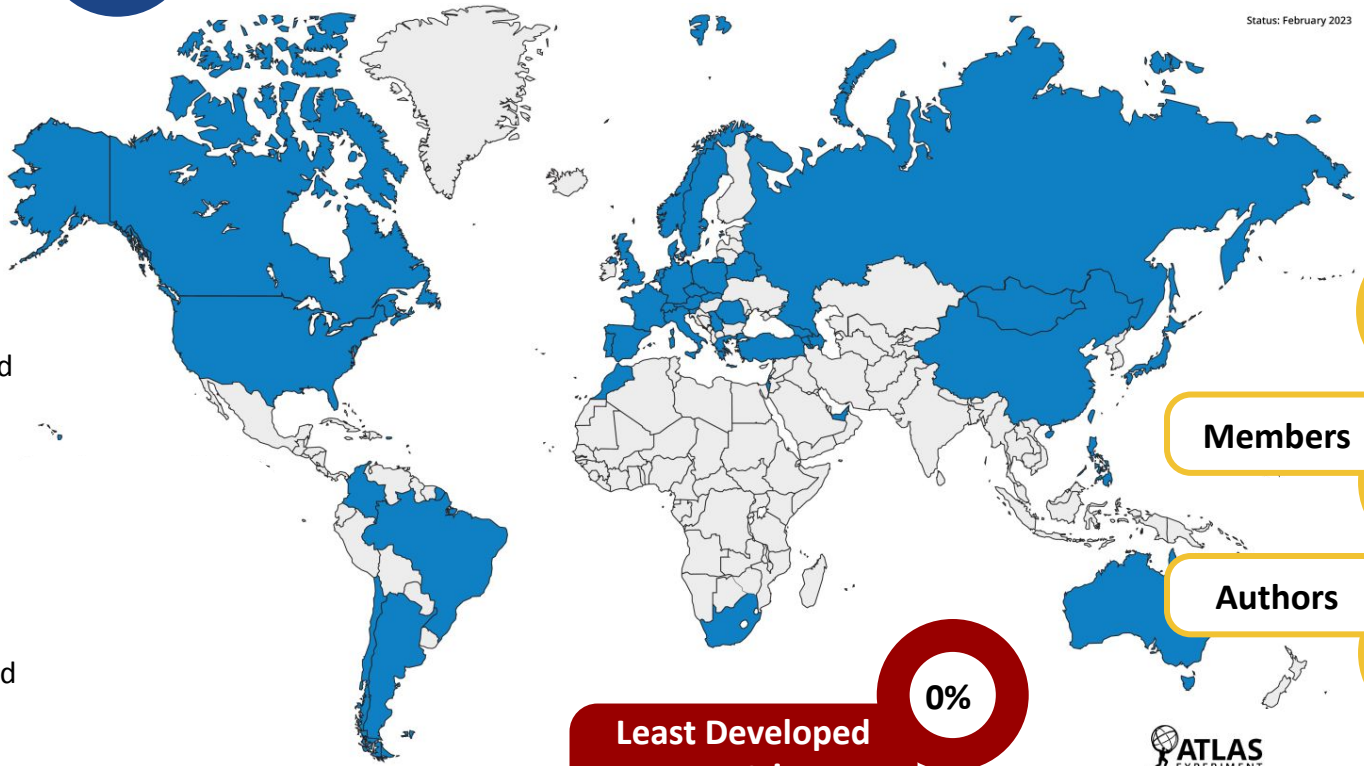
ATLAS EXPERIMENT

ATLAS Collaboration

3000 authors, 249 institutes, 42 countries

Developed countries — 55%

Australia
Austria
Canada
Czechia
Denmark
France
Germany
Greece
Israel
Italy
Japan
Netherland
Norway
Portugal
Slovakia
Slovenia
Spain
Sweden
Sweden
Switzerland
Taiwan
UK
USA



Emerging countries — 14%

Argentina
Brazil
Chile
China
Russia
South Africa

Developing countries — 31%

Armenia
Azerbaijan
Belarus
Colombia
Georgia
Mongolia
Morocco
Philippines
Poland
Romania
Serbia
Turkey
United Arab Emirates

Members — 5%

Authors — 4%

Least Developed countries — 0%

Highlight: ATLAS-Morocco

since 1996

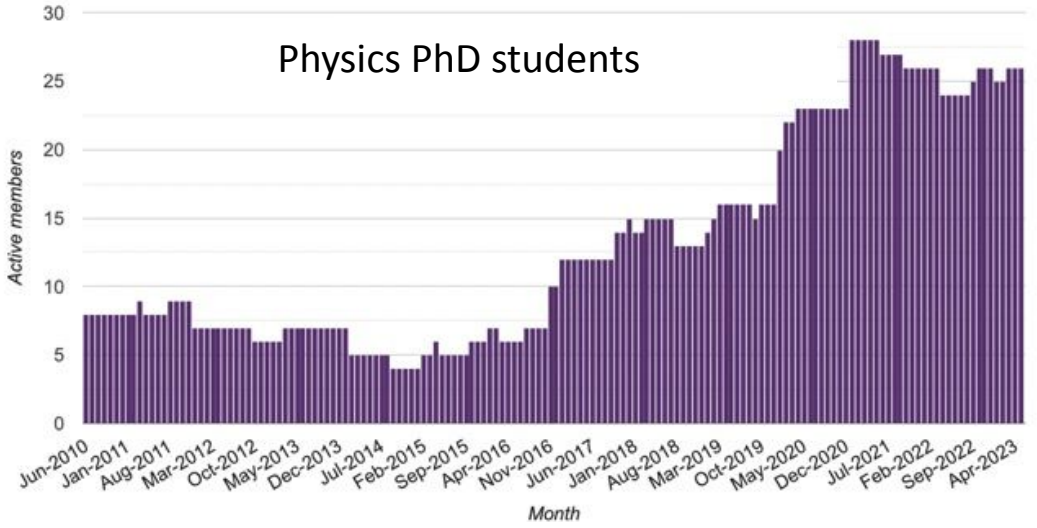
Start: teams Casablanca + Rabat worked with Université de Grenoble

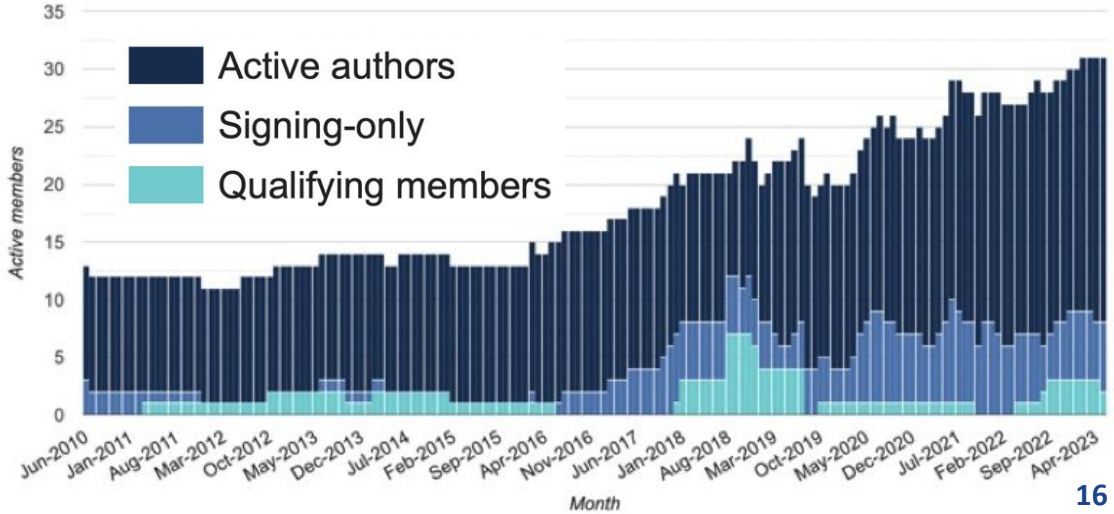
1 cluster with 6 institutes
+ 1 Technical Associate Institute

59 members including:

- 25 authors
- 26 Physics PhD students

Dynamic development with contributions in Phase-II Upgrade: High Granularity Timing Detector





ATLAS South Africa

since 2010

Started via association with BNL

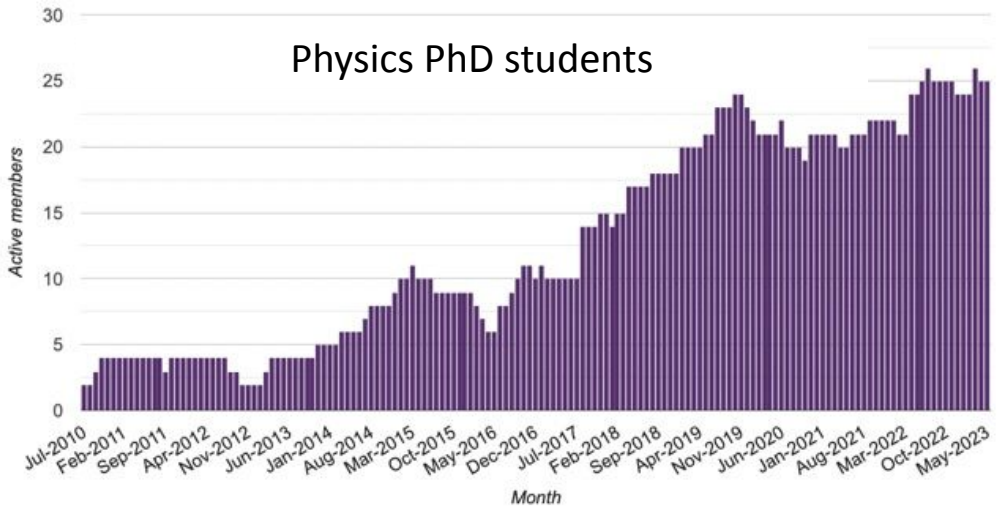
1 cluster with 6 institutes
+ 1 Associate Institute

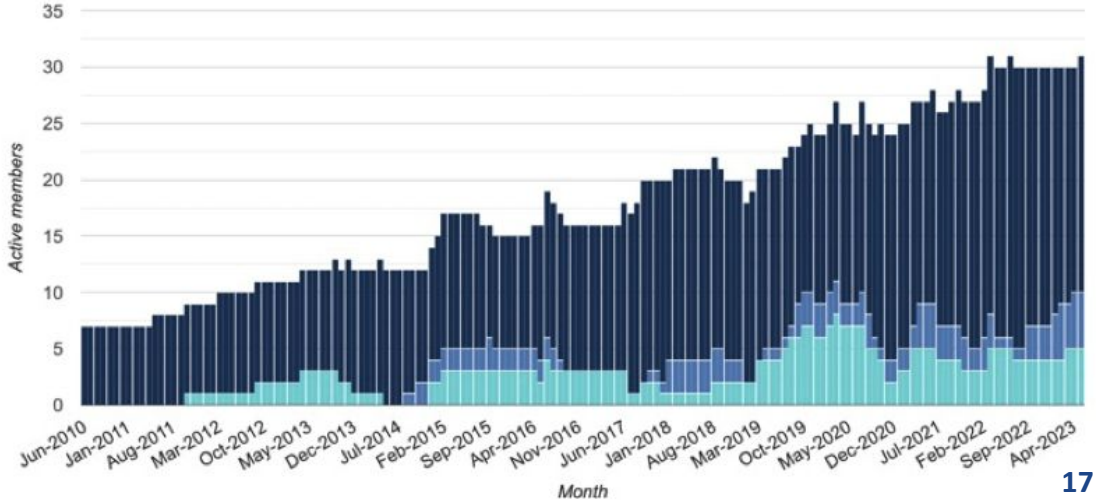
97 members including:

- 26 authors
- 25 Physics PhD students

Rapid growth with contributions in Phase-II Upgrade:

- → Inner Tracker Strip detector
- → Tile Calorimeter





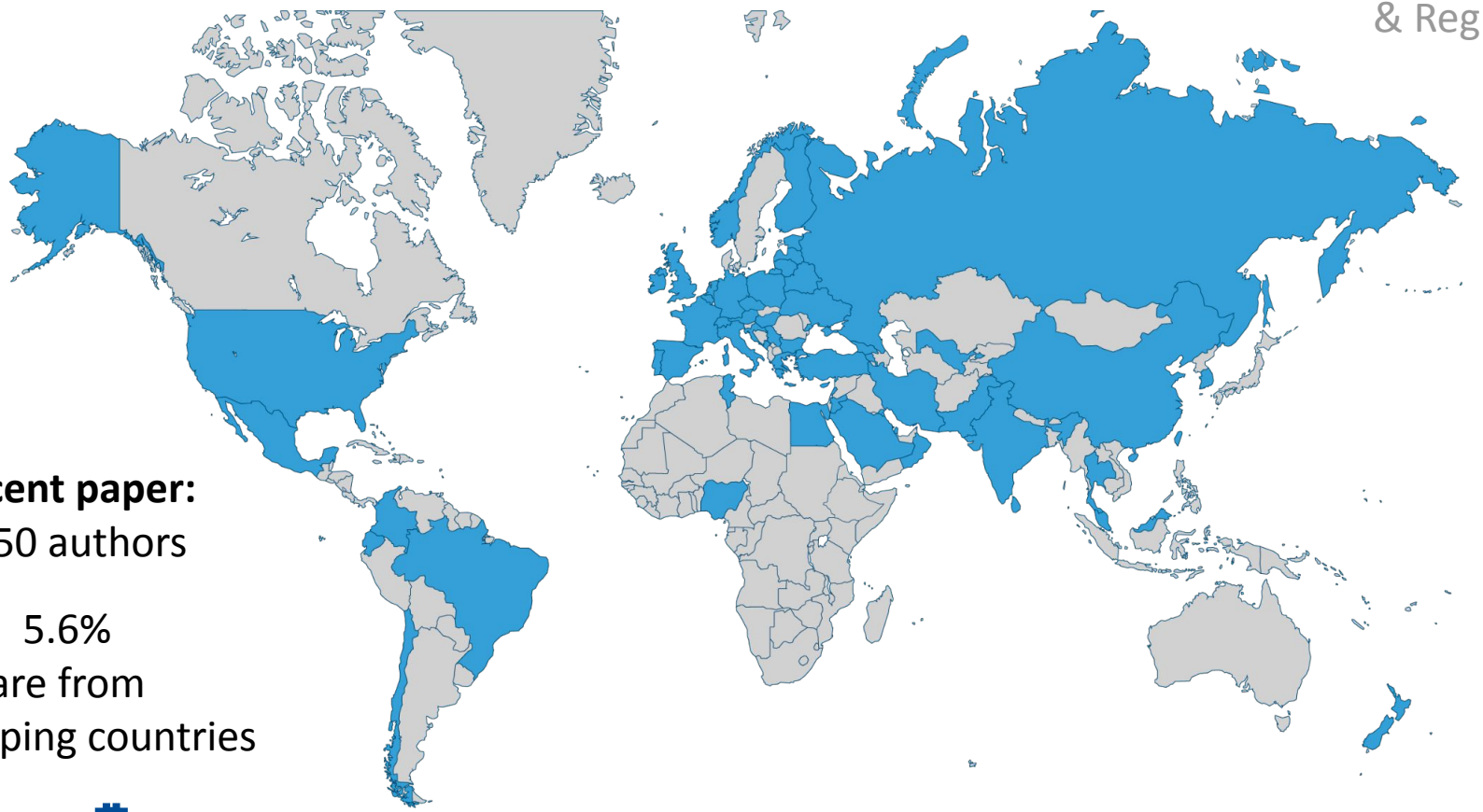
CMS Collaboration

3394 Physicists

1102 Engineers

282 Technicians

57 Countries & Regions

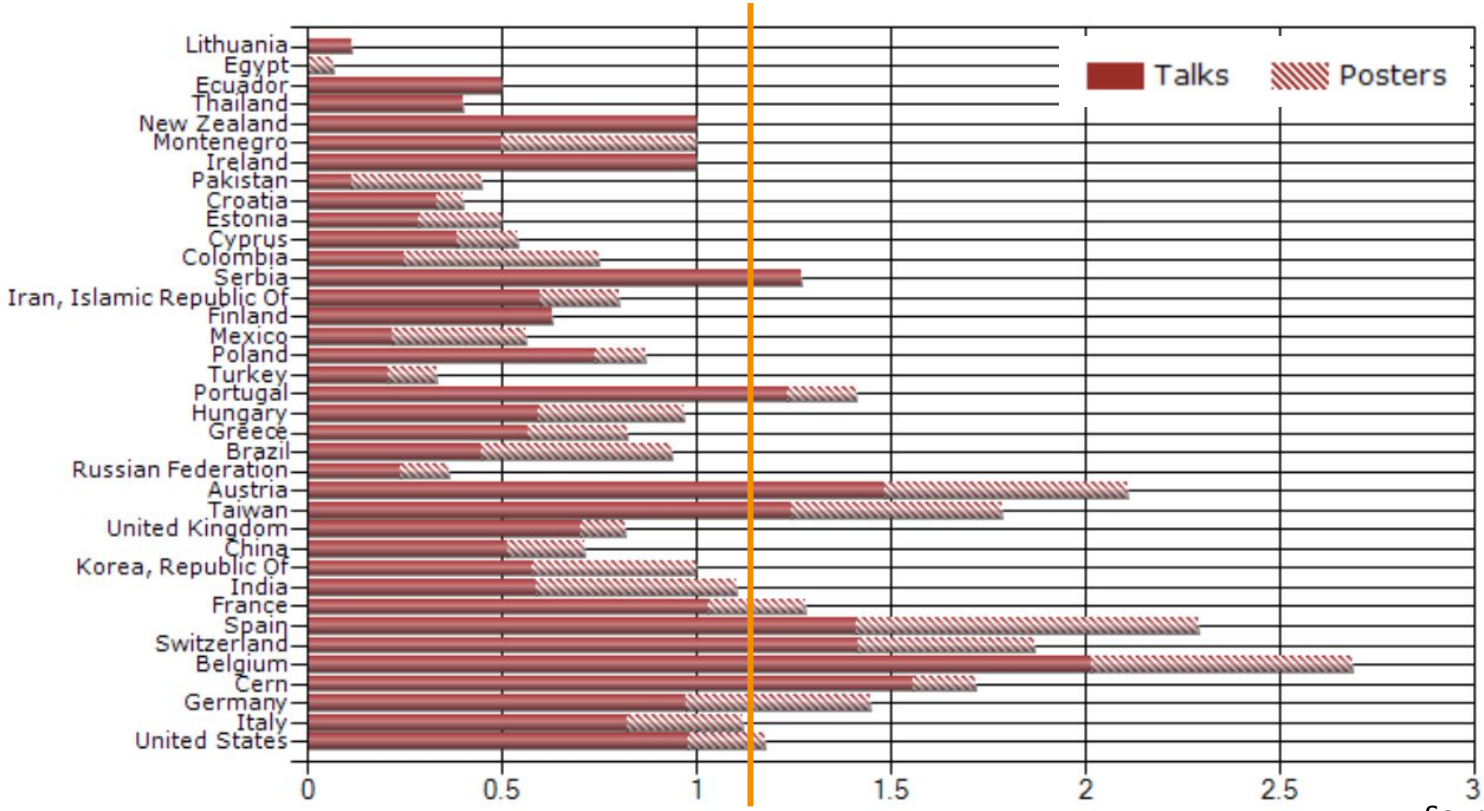


Recent paper:
2350 authors

5.6%
are from
developing countries

CMS: diversity in presentations at major conferences

All database: **2562 talks** over 15 years ↶ Average: **1.14 talks + posters** per physicist or PhD student



High numbers for big CMS groups/countries

But
Russia, China & India below average

Small numbers so significant fluctuations

← CERN: no students (so more talks)

Source: CMS Conference Committee

CMS: recent collaborators

Full, Associate or Cooperative members

Since 2021, the CMS Collaboration has accepted the following as new member institutes:

University of Tarapaca	Chile	Asia
Warsaw University of Technology	Poland	Europe
Universidad Técnica Federico Santa Maria	Chile	Latin America
DIETI Department, Optoelectronics Group, Naples	Italy	Europe
Tallinn Uni. of Technology	Estonia	Europe
King Abdullah Uni. of Science and Technology	Saudi Arabia	Middle-East
University of Benin	Nigeria	Africa
University of Tunis	Tunisia	Africa
Vinča Institute of Nuclear Sciences	Serbia	Europe
PAK-Austria Fachhochschule	Pakistan	Asia
Shandong University	China	Asia
South China Normal University	China	Asia
Mansoura University	Egypt	Africa
Gangneung-Wonju National University	South Korea	Asia
Nanjing Normal University	China	Asia
Yildiz Technical University	Türkiye	Middle-East

Other experiment(s)

Deep Underground Neutrino Experiment (DUNE)

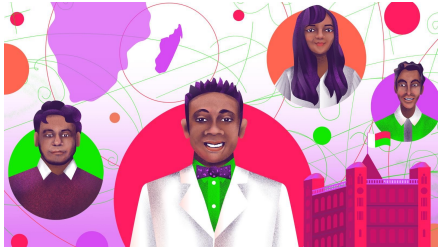
+1000 collaborators

200 institutions

35 countries + CERN

First African institution to join DUNE

The story in Symmetry Magazine



2010: Laza Rakotondravohitra attended African School of Physics (1st edition)

2012: Started as international fellow at Fermilab. Met David Martinez (Colombia)

2015: PhD defense, started training students from Madagascar and Colombia

"Rakotondravohitra and Martinez quickly realized that the missing ingredient was exactly what they had gained during their fellowships: research experience."

Madagascar became in 2015 the first African country to join the DUNE Collaboration

"We are the only African country right now, but we hope others will join," Rakotondravohitra

2023: 6 active graduate students: 2 PhD + 4 MSc

- 2 students benefited from a 6 month training in BNL via the ASP initiative
- 1 student starting a PhD in US, 1 interviewing
- Currently recruiting new students to reach 10 group members

Game-changers

“It’s all about connections”

African Strategy for Fundamental and Applied Physics

ASFAP is mandated by the African Physics Society. Proposed in 2020 by:


Dr. Kétévi Assamagan


Prof. Simon Connell


Prof. Farida Fassi


Prof. Shaaban Khalil


Dr. Fairouz Malek

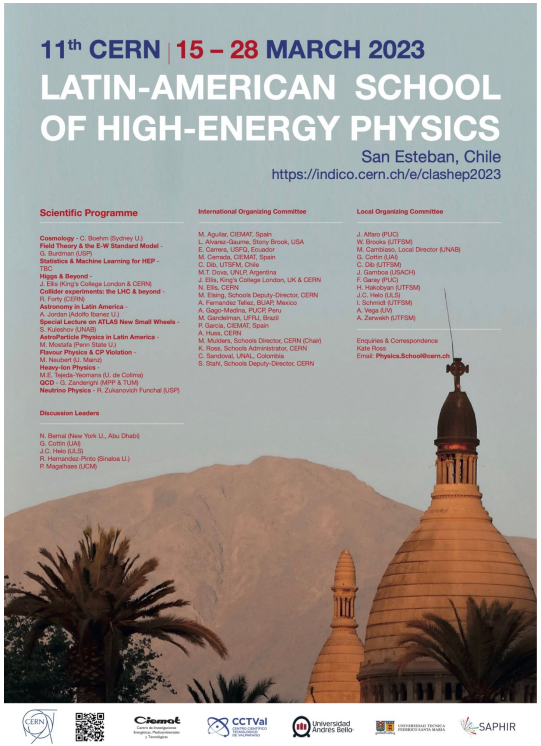
Vision: Africa should take its equal place as a **co-leader in the global scientific process**, along with all the social-economic benefits thereto.

Objectives: increase African education and research capabilities, engage African scientists, define most impactful physics priorities for Africa, release strategy report [7 - 10 years]

Schools & Programs

Bangladesh China Vietnam,
Sri Lanka Pakistan India Nepal

Latin-America: CLASHEP



Africa: ASP

Asia: BCVSPIN

African Institute of Mathematical Sciences (AIMS)

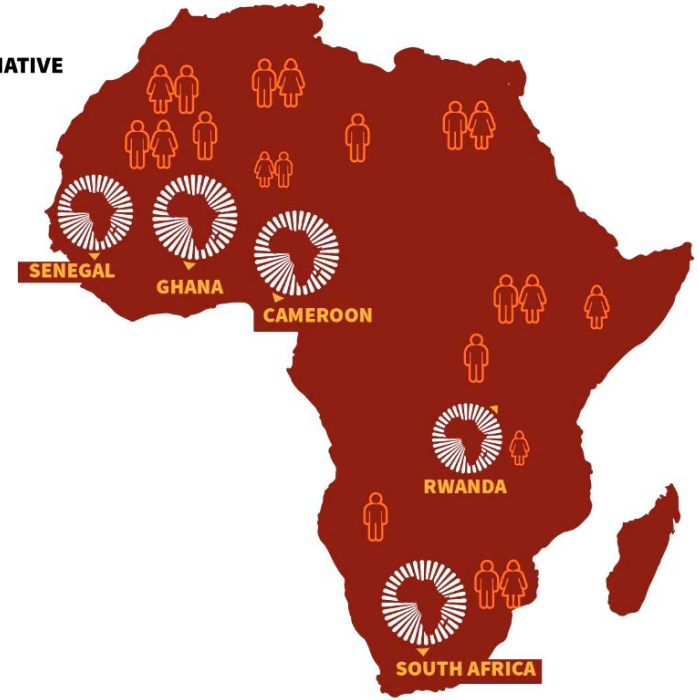
"Pan-African network of centres of excellence enabling Africa's talented students to become innovators driving the continent's scientific, educational and economic self-sufficiency."

AIMS | African Institute for Mathematical Sciences
NEXT EINSTEIN INITIATIVE

1,782 Alumni

32% Women

70% Alumni remain on continent



2019
5 Centres of Excellence

2023
15 Centres of Excellence Planned

Our students come from
43 countries

The students will be exposed to an innovative learning approach that fosters:

- Independent thinking
- Problem solving
- Communications & programming
- A Spirit of Leadership

Some reading

“Why should the U.S. care about high energy physics in Africa and Latin America?”

Snowmass paper on status of HEP in Latin America & Africa arXiv:2203.10060

Highlighting engagements that can benefit US but most examples non-US centric

Submitted to the Proceedings of the U.S. Community Study
on the Future of Particle Physics (Snowmass 2021)

Snowmass 2021 CEF03 Diversity, Equity & Inclusion

Why should the U.S. care about high energy physics in Africa and Latin America?

Kétévi A. Assamagan[a,*], Carla Bonifazi[b], Johan Sebastian Bonilla Castro[c], Claire David[d], Claudio Dib[e], Lucílio Dos Santos Matias[f], Samuel Meehan[g], Gopolang Mohlabeng[h], Azwinndini Muronga[i]

Takeaways

Takeaways

At the institute level

- We need data about regional representation of LHC experiments - centralized?
- We need more institutes like BNL, Grenoble, Trieste et al to kickstart efforts
- We need special treatments to welcome countries with very low or zero budget
- We need stronger synergies between CERN & AIMS, ASFAP, ASP, BCVSPIN, CLASHEP, etc

At the individual level, as scientist

- Advertise events, schools, programs that can be life-changing for someone
- Join or initiate research supervision with students from developing countries
- Donate your computer!
- Volunteer to teach!

Contact: claire.david@cern.ch

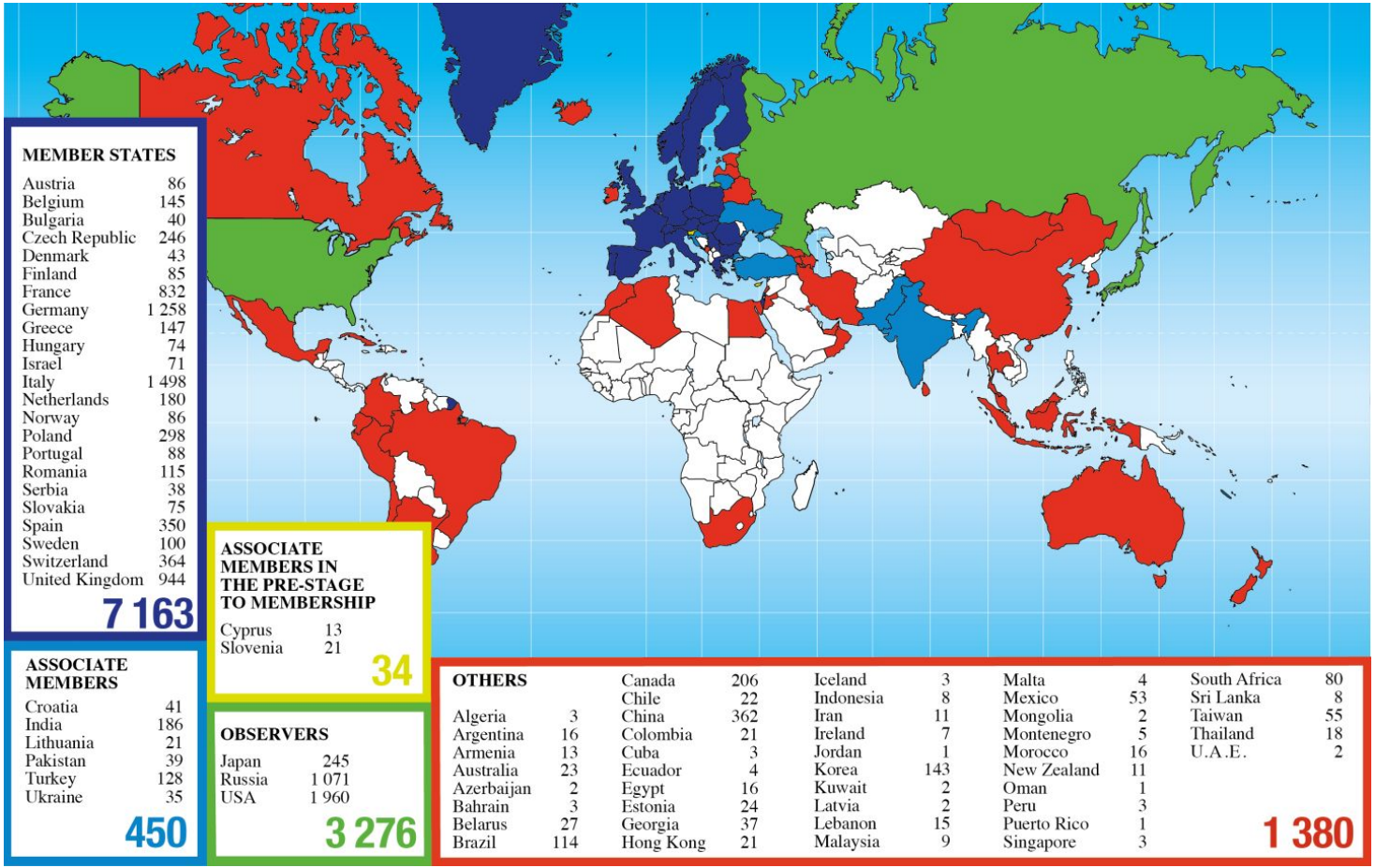
Shameless advertisement for KENTE CONNECT

by CERN alumni Sam Meehan & Joshua Smith

laptops donation & IT training in Ghana website

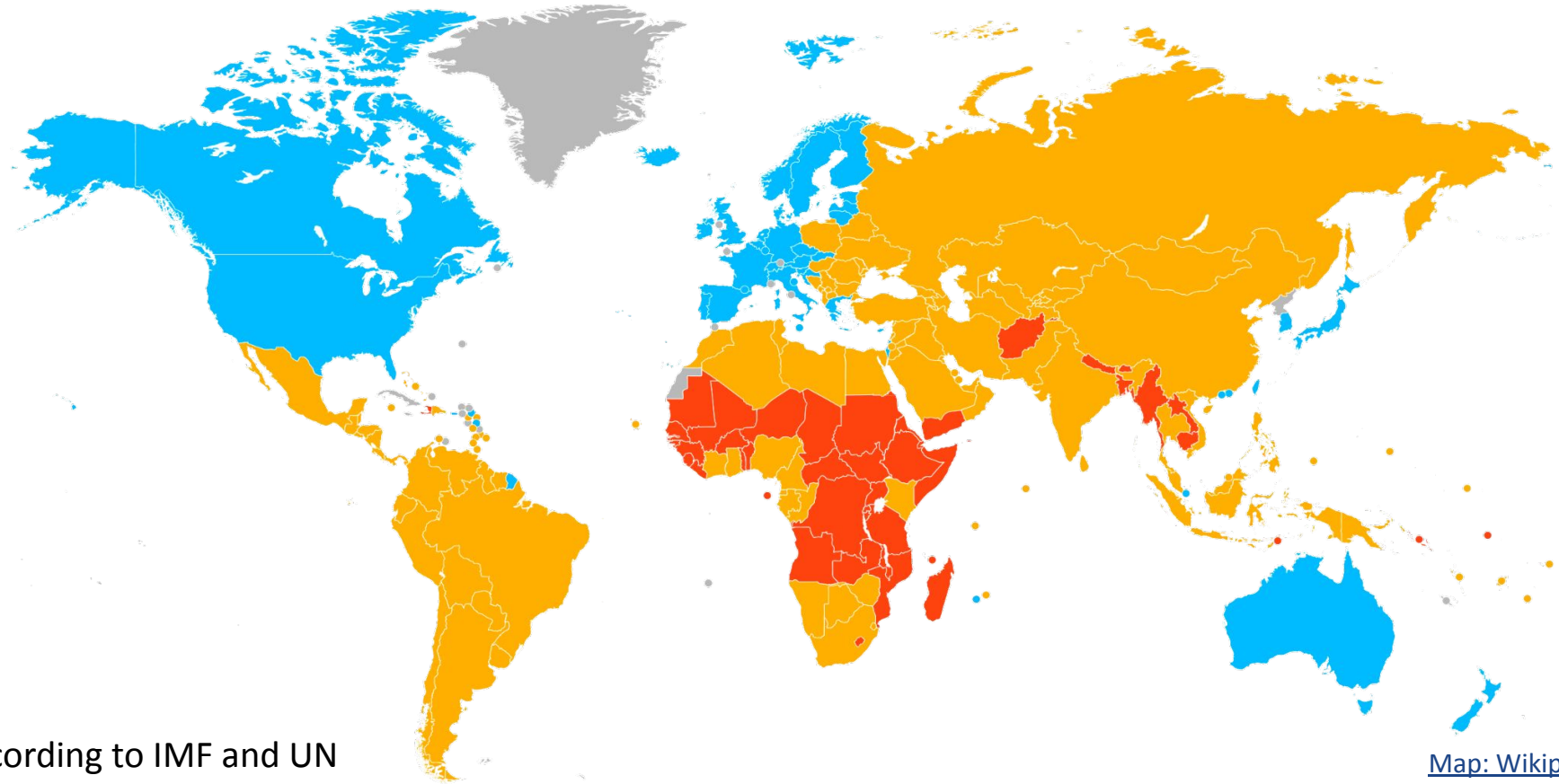
Extra

Distribution of CERN Users by location of institute (2020)



How many developing countries are there in the world?

Developed, developing and least developing countries

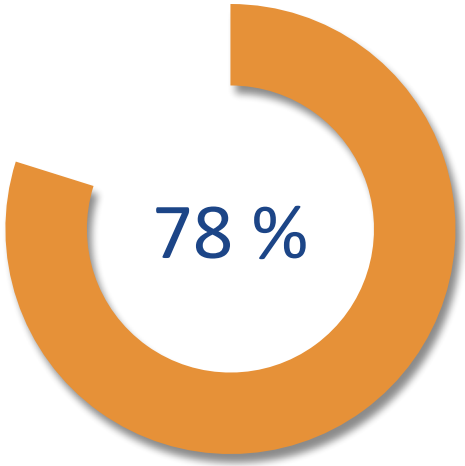


According to IMF and UN

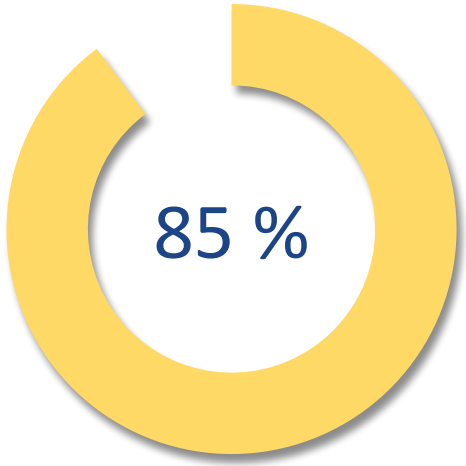
Map: Wikipedia

Developing countries

152 countries



6.77 billion people



According to the IMF definition