

Azwinndini Muronga

The need for cultural and structural change within the international high energy physics community to open equitable access and success for Africa.

XLI International Conference on High Energy Physics
Bologna, Italy
6 - 13 July 2022

Science is global - virtually connected



Bologna, Italy



Gqeberha, South Africa

Diversity & Inclusion @ Nelson Mandela University

Diversity and Inclusion at Mandela University

This starts at leadership level:

Chancellor - Geraldine Fraser-Moleketi,

Vice-Chancellor - Professor Sibongile Muthwa

Chair of Council - Ambassador Nosipho January-Bardill.

- Two of the four Deputy Vice-Chancellor positions are occupied by women
- Four of the seven Executive Deans are women

Building a culture of Diversity & Inclusion starts at home.



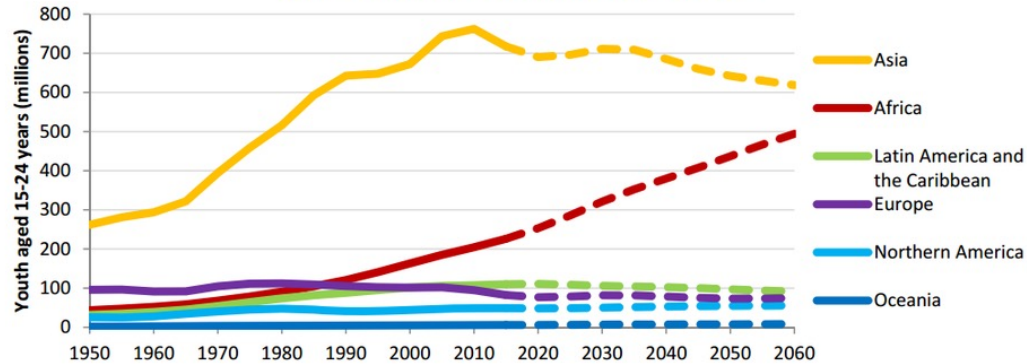
Highlights of my talk

- Why should the international HEP community care about Africa?
- What should the international HEP community do with Africa?
- There is a growing movement of HEPA in Africa.
 - HEP = High Energy Physics
 - HEPA = High Energy Physics and Astrophysics

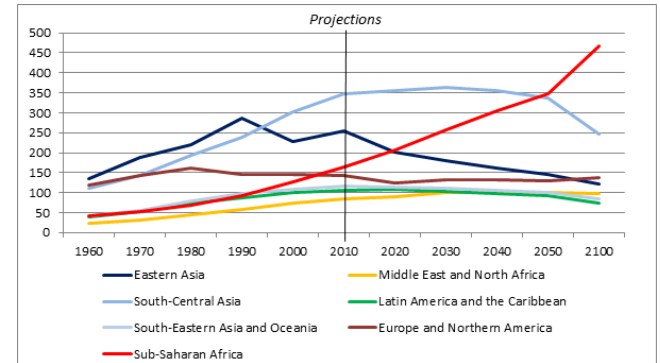
Why should the international HEPA community care about Africa?

The rise of Africa's Youth population

Figure 1. Youth aged 15-24 years, by region, 1950-2060



Data source: United Nations (2013) World Population Prospects: The 2012 Revision.



UNESCO: Priority Africa Flagship Programmes and Actions

- Strengthening education systems for sustainable development in Africa
 - Fostering science for the sustainable management of Africa's natural resources and disaster risk reduction
 - Harnessing STI and Knowledge for the Sustainable Socio-Economic Development in Africa
-
- Africa is positively changing at an extraordinary speed.
 - But with change also comes risk.
 - Rapid urbanization, growing population, youth unemployment, inequality and social exclusion, new natural resource finds and a changing climate as well as peacebuilding processes, all have the potential to place African societies under considerable strain.

<https://en.unesco.org/priorityafrica/flagshipprogrammes>

UNESCO: Priority Africa Flagship Programmes and Actions

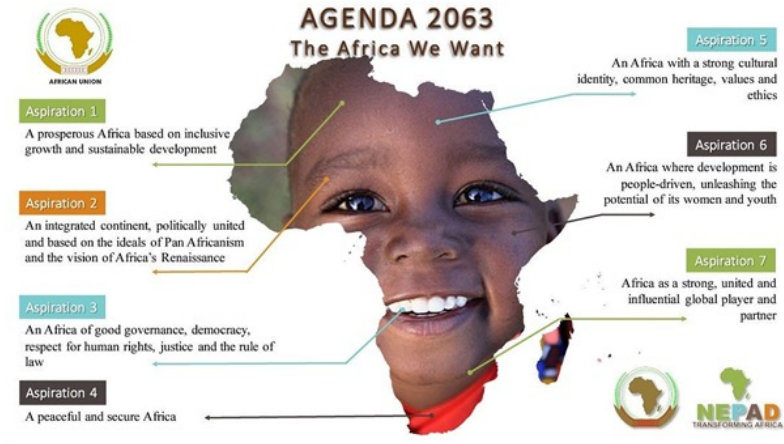
- Stability and prosperity start in schools, with quality education, to teach skills for jobs, and skills for peace to all African youth. In a continent where more than 60% of the population is under 25 - empowering people means educating youth, especially girls.
- The cradle of humanity is a powerhouse of cultural diversity and the “big origin” story.
- Education is moreover about learning values for citizenship, stability, and security.
- It is about teaching the history of Africa that has shaped the world.
- It is about living together, and teaching media including ICT, STI and social networks to respond to socio-economic challenges

<https://en.unesco.org/priorityafrica/flagshipprogrammes>

Africa and the UN SDGs

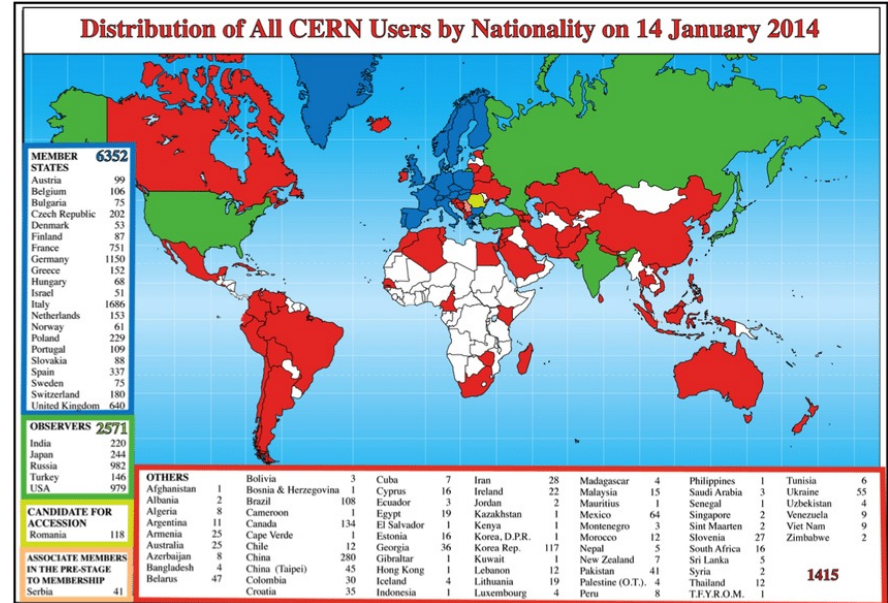
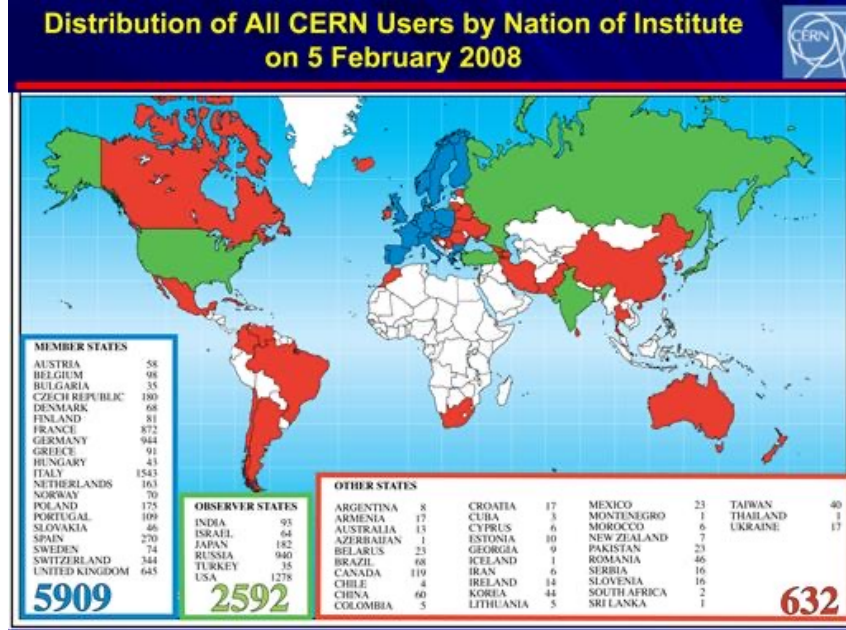


Africa is expected to play a significant role in achieving the sustainable development goals.



Africa will have continental events on IYBSSD and IUPAP Centenary celebrations

High Energy Physics in Africa

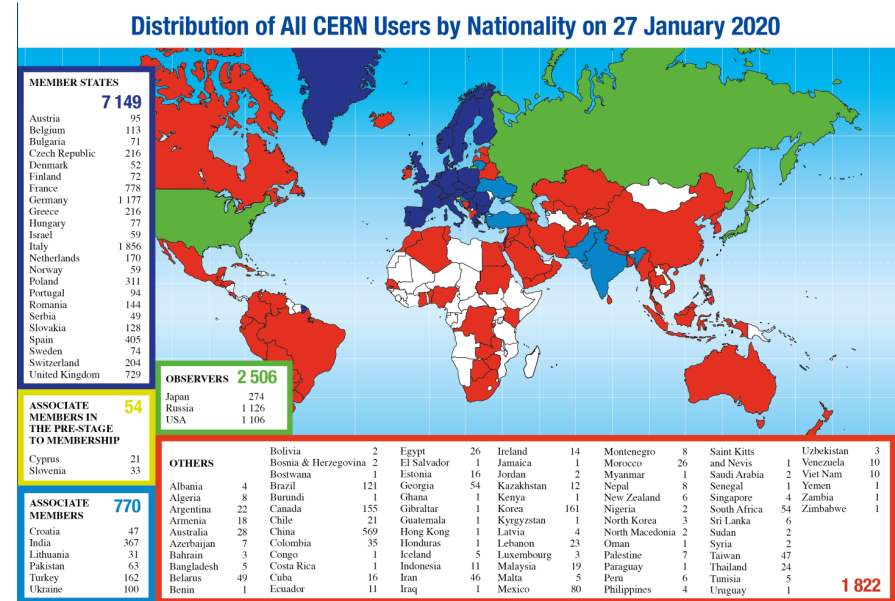


Africa's participation in international HEP

- Africa's participation in international HEP facilities remains extremely low.

About 1.1% of CERN users are African Nationals

Not limited to CERN, a broader issue



Africa's participation in international HEP

- About 43 countries with one African country
- About 178 institutes of which 2 are from South Africa
- Over 1900 members of which 5 are from South Africa



South Africa
SA-CERN programme
ATLAS, ALICE, ISOLDE, CERN, Theory



Participating institutions : 1 National Facility (iThemba LABS) and 10 Universities

	ATLAS	ALICE	ISOLDE	Theory	Total
PhD	6	5	6	8	25
MSc	19	2	7	15	43
Accad Staff	7	6	6	7	26
Tech Staff	3				3
Post Docs	5	2	2	2	8

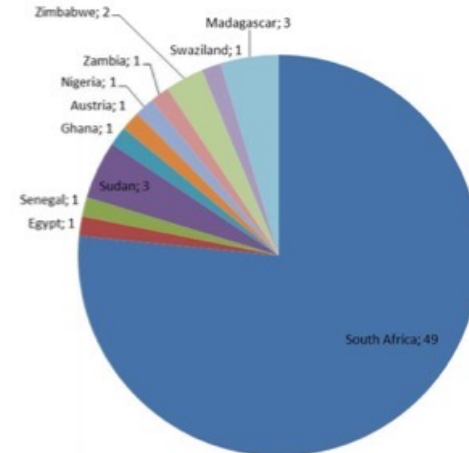
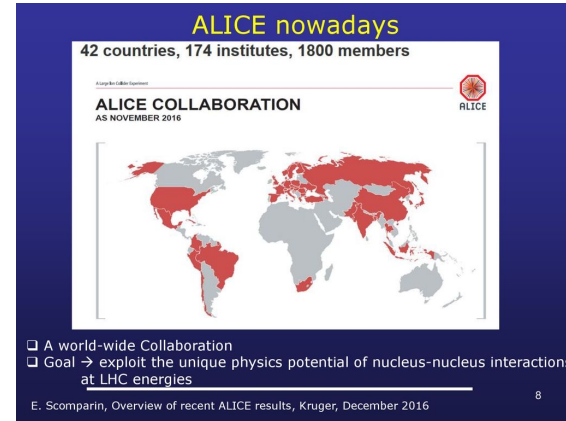
2017 numbers, increasing trajectory

- SA has a long history in High Energy Physics, eg : 1st neutrino discovered and studied in nature 1965
 - Long history at CERN, BNL, JLAB, JINR, others
 - Also a long history of theoretical contributions
- **SA-CERN Co-operation Agreement 1992**
- Now formal participation at CERN and JINR

Most HEP now in the SA-CERN and JINR Programmes

- ALICE since 2001
- ATLAS since 2010
- ISOLDE since 2017
- Theory
- JINR since 2005

*Decades of
"ad hoc"
participation*



Courtesy of Simon Connell

Change the World

Africa participation at ICHEP

Summary and Outlook



ICHEP 2018, Seoul (7/11/18)

- Introduction
- Happy 50th birthday Standard Model!
- ICHEP 2018
- Thoughts for the future

Paul Langacker (IAS)

- **Broad and exciting conference**
 - Experiment, phenomenology, theory, astro-particle, accelerator, detector, computing, education, diversity, applications
 - **1119 participants** (213 women, 906 men)
 - **835 parallel talks in 16 sections**
 - **41 plenary talks**
 - **2 award lectures**
 - **6 satellite meetings**
 - **2 public lectures**
 - **226 posters** (3 award talks)
 - **Director's panel**
- **Not a detailed/complete summary**

ICHEP 2018, Seoul (7/11/18)

- Asia/Pacific: 560
- Europe: 414
- N/S America: 137
- Africa: 8
- Antarctica: 0



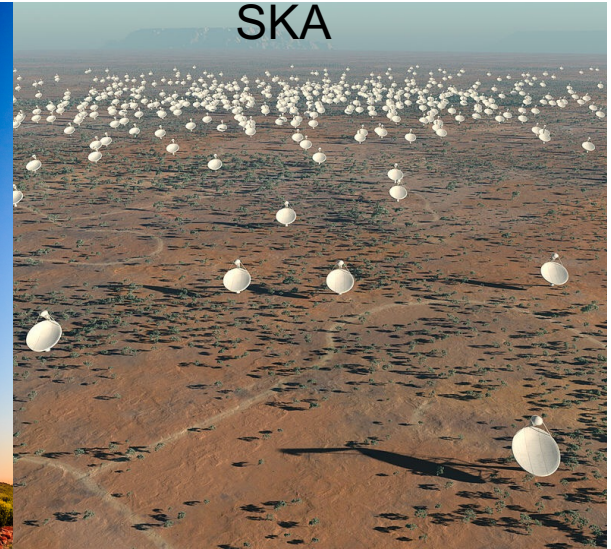
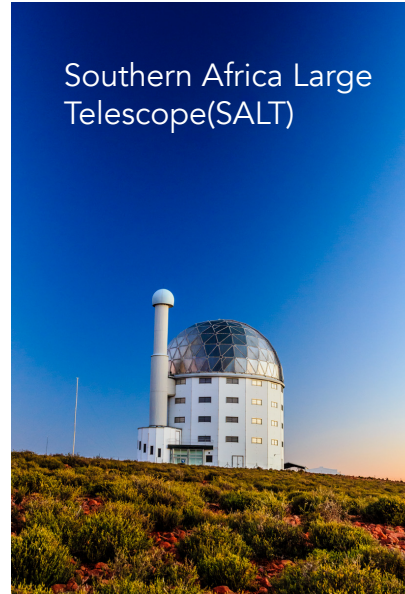
Paul Langacker (IAS)

Africa is fertile with possibilities

Why is HEPA capacity building in Africa important?

- Major research research facilities coming to Africa
- SKA - The largest radio astronomy observatory to be (co-) hosted by South Africa (70%) and Australia (30%) : meaning that two Global/Geographical South nations will be at the heart of managing and driving the project; and this will need a large African STEM workforce
- Africa and in particular Southern Africa has geographic advantage in astronomy research (besides point of human origins)
- In Africa the diversity challenge is both local and global.

Multi-messenger Astronomy



SKA science and the birth of multi-messenger astronomy

THE ASTROPHYSICAL JOURNAL LETTERS, 848:L12 (59pp), 2017 October 20

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OPEN ACCESS

<https://doi.org/10.3847/2041-8213/aa91c9>



CrossMark

Multi-messenger Observations of a Binary Neutron Star Merger

LIGO Scientific Collaboration and Virgo Collaboration, Fermi GBM, INTEGRAL, IceCube Collaboration, AstroSat Cadmium Zinc Telluride Imager Team, IPN Collaboration, The High Energy Gamma-Ray Initiative, ANTARES Collaboration, The GEM Collaboration, AGILE

A comparison between SALT/SAAO observations and
kilonova models for AT 2017gfo: the first electromagnetic
counterpart of a gravitational wave transient – GW170817

Buckley et al.

McCully et al.



Rural capacity building

- Science engagement in primary and secondary schooling education system
- Going from province to province visiting schools and HEIs
- Talking about wonders of nuclear physics, particle physics, astrophysics, and cosmology
- Science Centres in SA have transformed into training Centres for STEM learners and educators



- Science engagement in rural schools, in open spaces and under trees
- These challenges require local solutions that are implemented globally
- No time to wait for luxury infrastructure



Capacity building through educator training

- Programmes for STEM educators
- Training teachers has ripple
- Effects – as evidenced by schools which improved their results
- SAIP has an educators development programme which has been very successful
- The programme is now rolled to the provinces and neighbouring African countries



Capacity building at universities

- Annual Hot and Dense Matter in Heavy Ion Collisions and Astrophysics (HDM) school and workshop
- The school curriculum covers introductory topics including mathematical physics, computational physics, nuclear physics, particle physics, astrophysics and cosmology
- The HEPP Workshop series - The topics to be covered will be high-energy theory and phenomenology (heavy ions, pp, ep, ee collisions), ATLAS physics and ALICE physics.
- National Institute for Theoretical and Computational Sciences (NITheCS) Internship Programme. The NMU-NITheCS internship programme is a 4 weeks+ programme in topics spanning nuclear and particle physics, astrophysics and cosmology

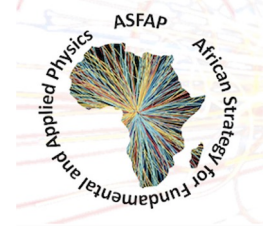


Capacity building in Africa

- The African School of Fundamental Physics and Applications (ASP)
- The African Conference on Fundamental Physics and Applications (ACP)
- The African Strategy on Fundamental & Applied Physics (ASFAP)



The African School of Fundamental Physics and Applications a.k.a. the African School of Physics (ASP)



Assessment of impact

<https://www.africanschoolofphysics.org/>

Dr. Kétévi A. Assamagan
on behalf of the ASP-IOC , IAC and LOC

ketevi@bnl.gov

Physicist at
Brookhaven National Laboratory (USA)



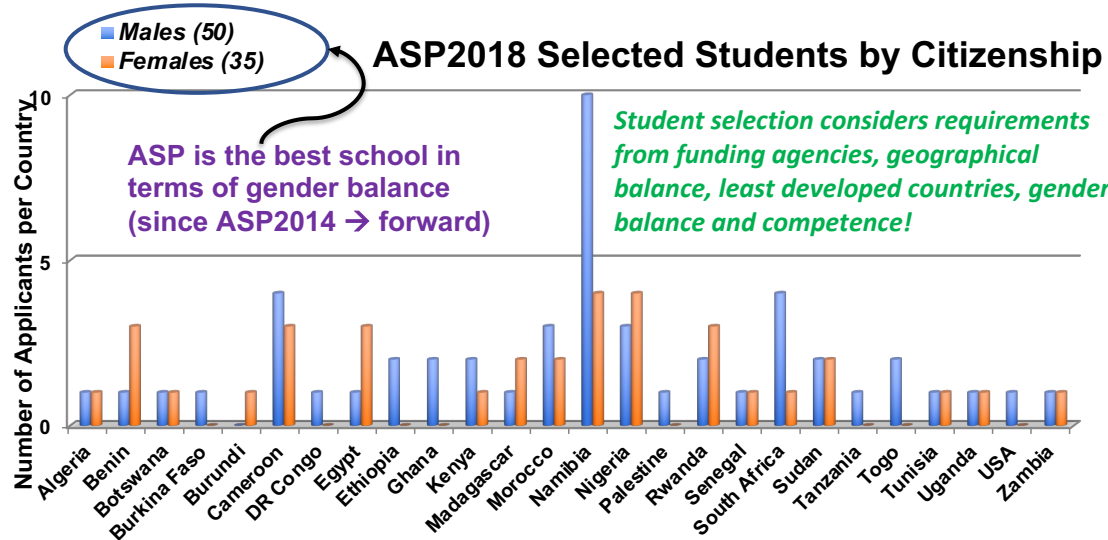


African School of Fundamental Physics and Applications

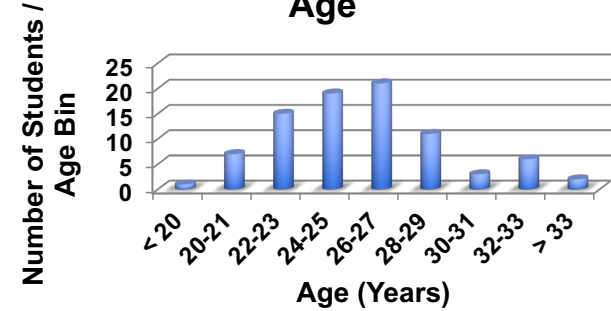
- Also known as “The African School of Physics”
- Acronym: ASP; Logo: as above
- <https://www.africanschoolofphysics.org>
- Organized biennially in different African countries since 2010 by an International Organizing Committee (IOC), ASP-IOC@CERN.CH

ASP	Host Country	Applicants	Students	Mentorship	Teachers	Pupils	Conference
2010	South Africa	125	65	Continuously, even when there is no formal school			
2012	Ghana	138	50				
2014	Senegal	330	70				
2016	Rwanda	429	75	Program formalized in 2016. Runs continuously	20	150	
2018	Namibia	523	85		63	> 1200	+60
2020	Morocco						
2021	Online	N/A	94				+649

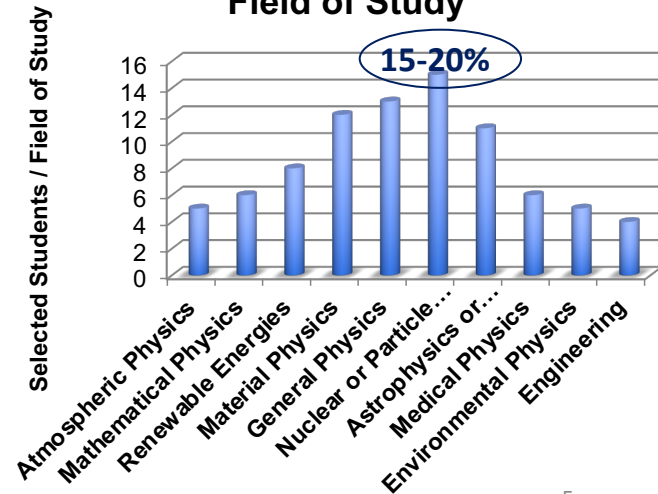
ASP2018 Students Profile



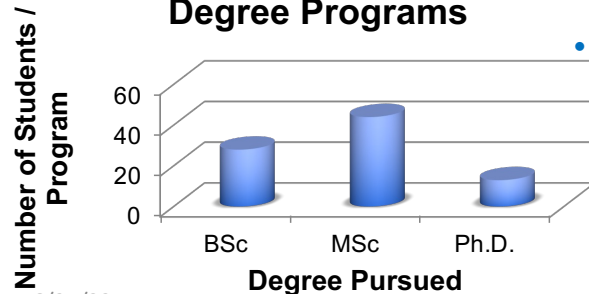
ASP2018 Selected Students by Age



ASP2018 Selected Students by Field of Study

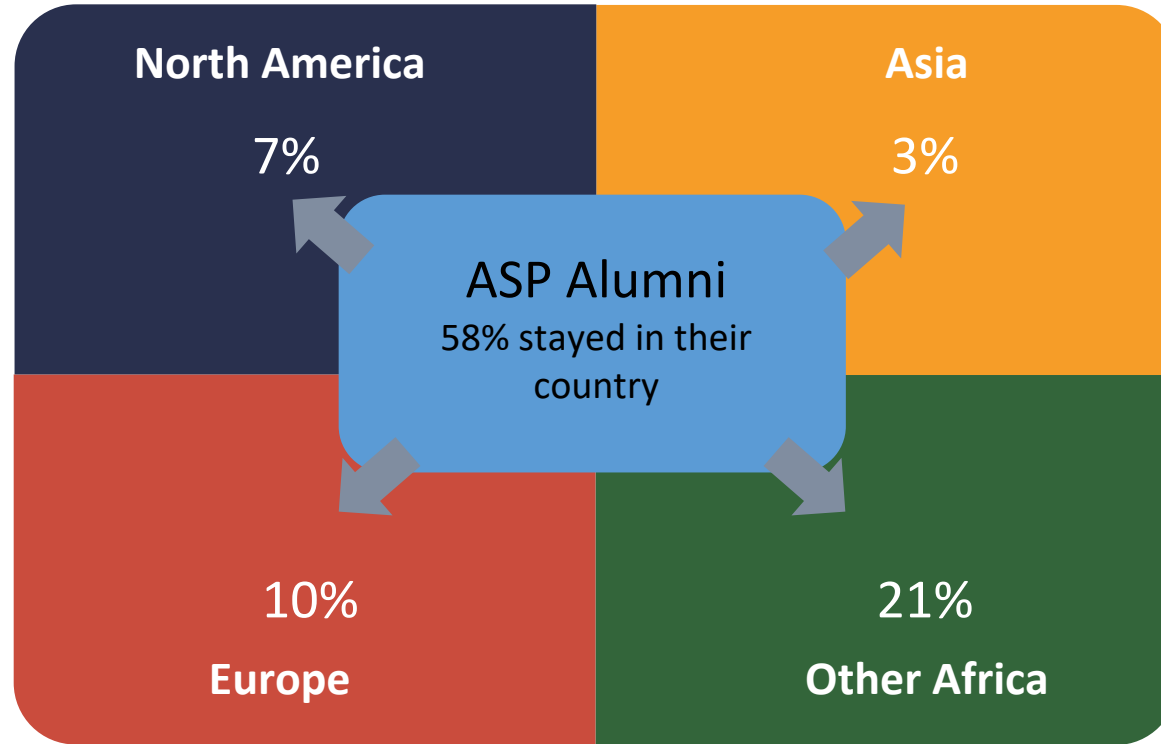


ASP2018 Selected Student Degree Programs



- 523 Applications
- Total Selected: 85
- There were 30 good students on the waiting list
- Selections constrained by budget and logistics
- Replace early declinations

Retention. Where do ASP alumni go?



Forum day



Dedicated to Knowledge and Transfer of Technology

Dr. D. ADAMS, chief director:
Emerging Research areas &
Infrastructure, Human Capital
and Knowledge Systems.



AfLS and compact acc.
Prof. H. WINICK, Prof.
Emeritus, SLAC and
Prof. L. SERAFINI
(INFN, IT)

**East Afr. Science and
New ICTP Center**
Rwandan Ministry of
Education



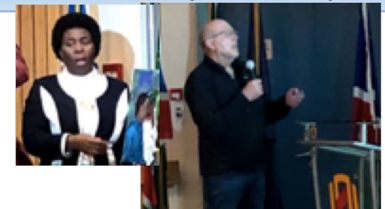
UN support

Dr. H. TOURE, UN ITU
Secretary General.

Prof. A. WAGUE and O. KA
M. NGOM - US Embassy rep.



Dr T. TJIVIKUA, Vice-
Chancellor, Namibia
University of Science and
Technology (Namibia)
Dr. R. ADAM (SKA, SA)



ASP workshop for high school teachers

- **Formalized and started in 2016**
 - during ASP2016 in Rwanda
- **In ASP2016**
 - 2016, 20 teachers for 2-day workshop
- **In ASP2018, 70 teachers from 14 regions of Namibia**
- **Teachers selected by the Ministry of Education of host country**



Windhoek, Namibia, July, 2018 ASP2018
Dr. Milind Diwan with high school teachers

ASP Outreach Program for learners

- **Formalized and started in 2016**
 - during ASP2016 in Rwanda
- **In ASP2018, we covered**
 - 39 high school around Windhoek
 - About 2000 learners
 - In one week
- **High schools selected by LOC, Ministry of Education of host country; pupils selected by the high schools**



Windhoek, Namibia, July, 2018 ASP2018
Dr. Kenneth Cecire with learners

ASP Structured Mentorship Program

- **Informal networking between ASP alumni and lecturers**
 - Always present and encouraged
- **Structure mentorship formalized and integrated in 2016**
 - Open to ASP alumni at PhD level
 - Runs on 2-year cycle
 - Pair alumni with ASP lecturers
 - Work with alumni academic advisors
 - **Does not replace them**
 - Light, information engagements
 - **Between mentor / mentee**
 - **For extra assistance / support if needed**



ASP alumni of 2018, some of whom has benefitted from the ASP Mentorship Program

The African Conference on Fundamental and Applied Physics (ACP)

- One week, integrated in ASP since 2018
- The first ACP took place in Namibia in July 2018
- Formalized to promote
 - Participation of African research faculties
 - Encourage participation of African students not selected for ASP due to budget constraints
 - International conference open to anyone

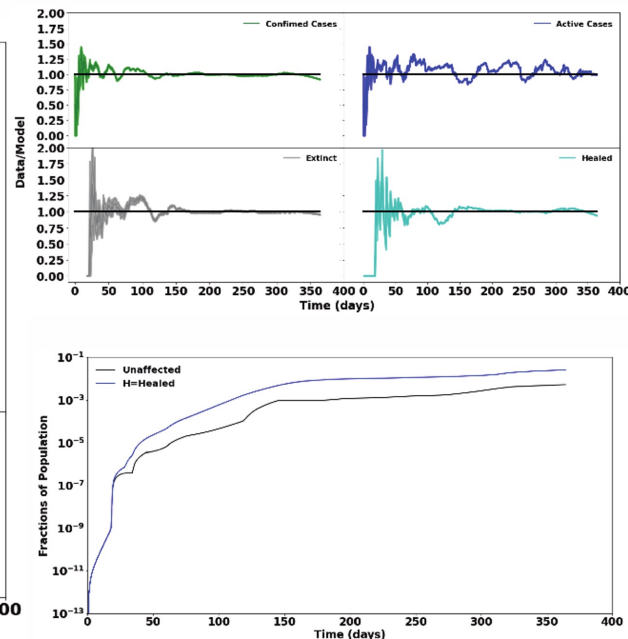
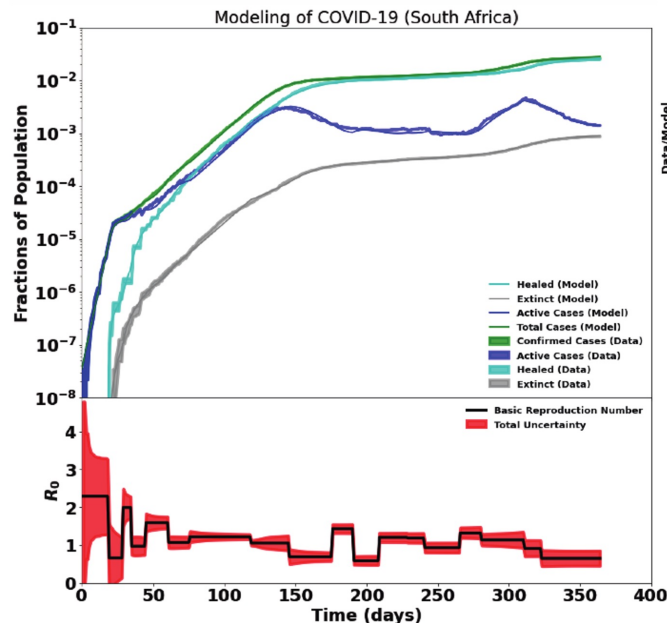


Prof. Lerothodi Leeuw at ACP2018

ASP Mentorship during COVID-19 Pandemic

APS alumni learned about

- ❖ Analysis tools in C++ and Python
- ❖ Understanding their data
- ❖ Modeling, goodness of fit
- ❖ Statistical analysis
- ❖ Uncertainties (statistical, systematic)
- ❖ Estimation of basic reproduction number R_0
- ❖ Giving scientific talks
- ❖ Writing a paper and responding referees comments



First 12 months of COVID-19 data of 10 countries analyzed
> 50% of all COVID-19 cases in Africa were analyzed by 13 African students

Study published in the Scientific African
<https://doi.org/10.1016/j.sciaf.2021.e00987>

6/27/22

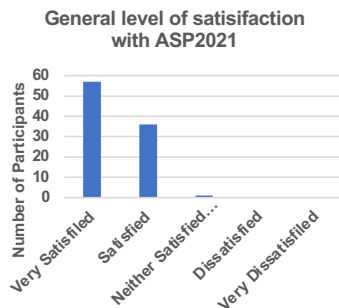
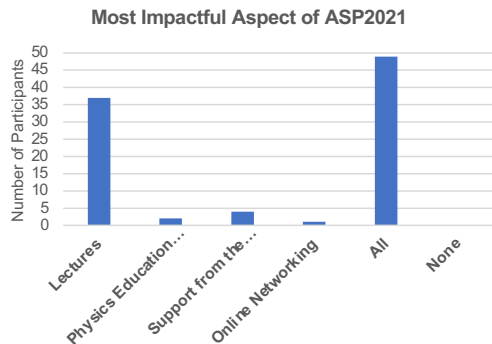
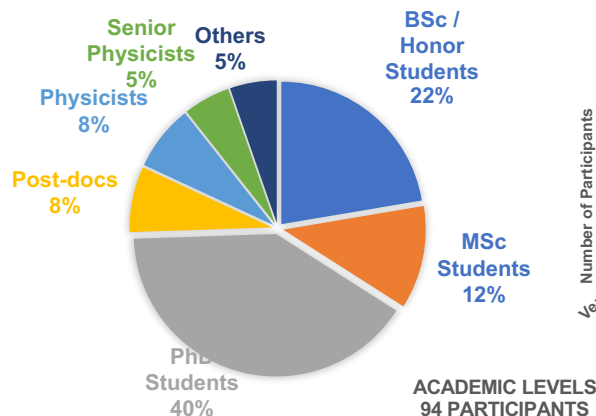
See the talk by Toivo S. Mabote (Mozambique, ASP2020 alumnus)
On Friday, March 11, 2022

Dr. Kétévi A. Assamagan (BNL)

ASP2021, July 19-30, 2021; online school

• ASP2020-Morocco

- Cancelled because of COVID-19
- A 2-week online version organized as ASP2021



THE SIXTH BIENNIAL



African School of Fundamental
Physics and Applications

July 19-30, 2021

Virtual Edition

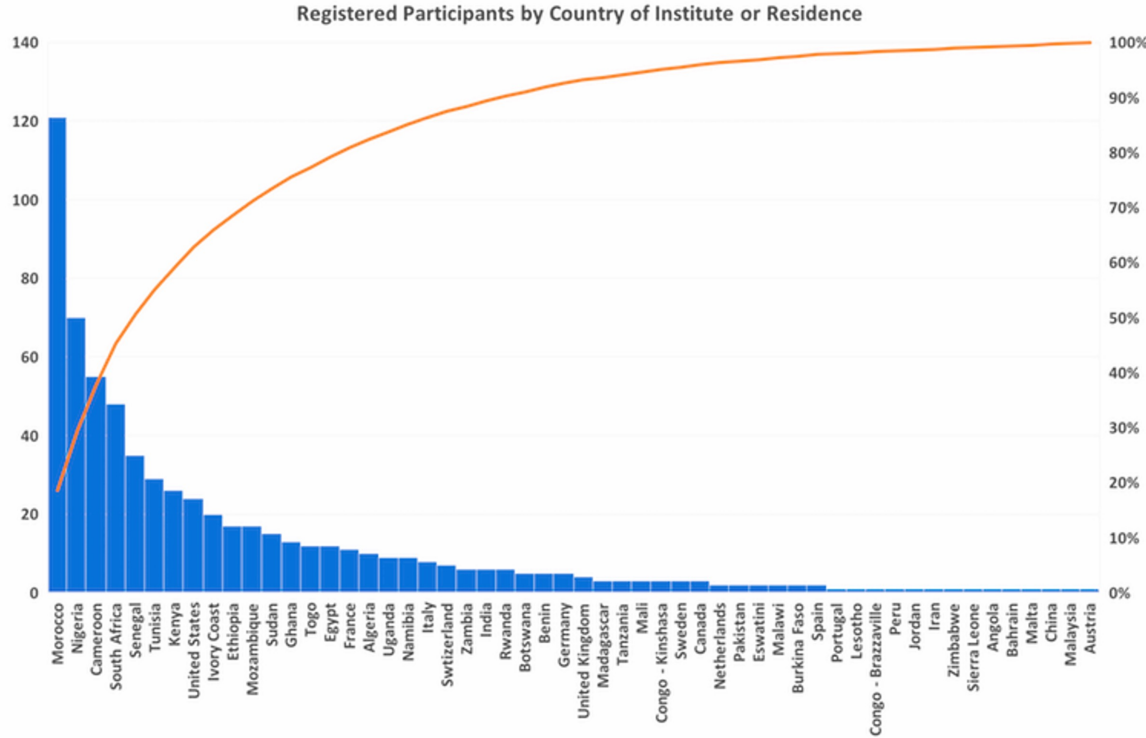


www.africanschoolofphysics.org



TOTAL:

ACP2021, March 7-11, 2022

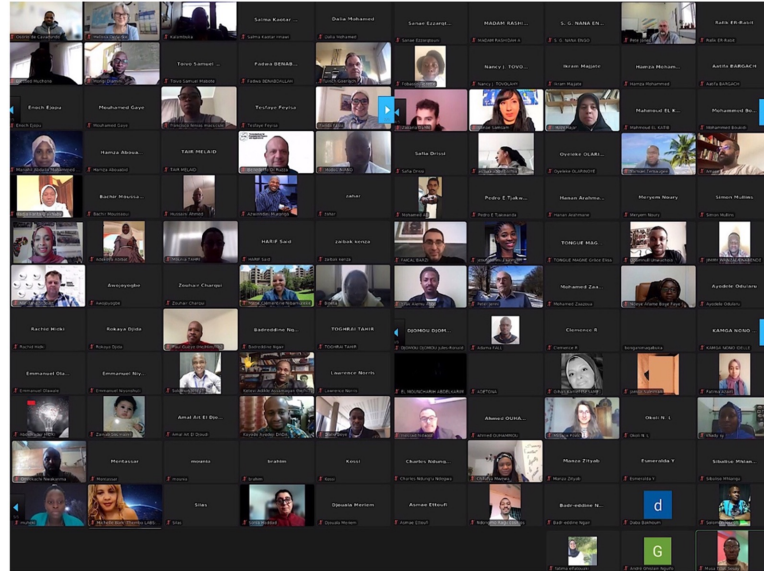


African countries where 563 participants have institutional affiliations

Participant group photo, March 11, 2022

The Second Biennial African Conference on Fundamental Physics and Applications

March 7-11, 2022



ASP2022/ ACP2022— South Africa

- The next host country of ASP is selected 2.5 years earlier
- The next host invited to join the organization of current ASP
- South Africa was selected in December 2019 to host ASP2022
- At Nelson Mandela University in Gqeberha on November 28 – December 9, 2022. However, ASP2022 will be organized in a hybrid mode
 - Site visit to South Africa on June 26 – July 2, 2022. Purpose of site visit:
 - Meet the LOC;
 - Secure support from host institute
 - Review logistics and make suggestions for improvements in time for the event
- Student applications closed on June 1, 2022
 - We received 339 applications
 - Application reviews will be finalized by July 15, 2022
 - We aim to select 100 students: 60 in-person, 40 online
- We will arrange a training program for high school teachers (50-70)
- Further, we will include an outreach program for > 1000 learners
- ACP2022 will take place in 2023
 - Still co-organized with NMU. Date and venue to be decided
- ASP2024 will be in 2024 in Morocco

To summarize

- **ASP was started in 2010**
 - as a 3-week biennial event in Fundamental Physics (and applications) for university students including the ASP Forum, to liaise with policymakers
- **It has since been extended to include, in addition**
 - Other fields of physics, of interest to Africa
 - Structured mentorship program continually for selected graduate students
 - A one-week workshop to train African high school teachers in the planning and delivery of physics instructions
 - A one-week physics outreach event to motivate African high school learners to develop and maintain interest in physics
 - A one-week African Conference on Fundamental and Applied Physics (ACP)
 - A weekly or bi-weekly online seminars or colloquia
 - 3- to 6-month short-term visits to U.S. laboratories for physics research

ASP was started in 2010, but has since evolved to be much more than a school—it has grown to become a program of continuous activities with directed ethos towards physics as an engine for development in Africa.



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The 7th Biennial African School of Fundamental Physics and Applications

28 November - 9 December 2022



Scientific Program

Topics

- Space Physics, Astrophysics & Cosmology
- Nuclear and Particle Physics
- Medical and Radiation Physics
- Biophysics
- Physics Education, Outreach, & Communication
- Diversity Equity & Inclusion-in Physics
- Condensed and Material Physics
- Photonics
- Applied and Industrial Physics
- Theoretical and Computational Physics
- Physics for Sustainable Development
- 100 Years of Physics in Africa and the Future

Activities

- Workshops for High School Teachers
- Outreach for Secondary Schools
- Physics Lectures and Tutorials for Students
- Forums to Discuss Capacity Development & Retention

**100 years of
Physics in Africa**
Past, Present, And
Future



Gqeberha (Formerly Port Elizabeth)



International Organising Committee (IOC)

B. Acharya (ICTP and King's College London)
K. Assamagan (BNL)
A. Dabrowski (CERN)
C. Darve (ESS)
J. Ellis (King's College London)
F. Ferretti (GSSI-INFN)
S. Muanza (CNRS-IN2P3)

Local Organising Committee (LOC)

V. Bongela (Nelson Mandela University)
N. Hashe (Nelson Mandela University)
A. Muronga (Nelson Mandela University)
R. Mosia (Nelson Mandela University)
S. Ngesi (Nelson Mandela University)
A. Tabalaza (Nelson Mandela University)
S. Thwala (Nelson Mandela University)
T. Trantaal (Nelson Mandela University)
EE. van Dyk (Nelson Mandela University)
A. Venter (Nelson Mandela University)
B. Masara (South African Institute of Physics)
N. Mahani (South African Institute of Physics)

Regional Organising Committee

S. Connell (University of Johannesburg)
M. Diale (University of Pretoria)
E. Maluta (University of Venda)
B. Mellado (University of the Witwatersrand) (iThemba LABS)
I. Gledhill (University of the Witwatersrand)
E. Kasai (University of Namibia)
RE. Simon (University of Botswana)
JM. Tshitenge (University of Kinshasa)
TD. Bucher (Cape Peninsula University of Technology)
Z. Katamzi - Joseph (South African National Space Agency)
JB. Habarulema (South African National Space Agency)
R. Maphanga (Council for Scientific and Industrial Research)
S. Mullins (Botswana International University of Science and Technology)

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World

African Strategy for Fundamental Physics & Applications (ASFAP)



- ASFAP is an opportunity for African physicists (including particle physicists) to come together, identify and document a scientific vision for the future of physics (including particle physics) in Africa.
- The particle physics community will define the particle physics' direction for the next decade: identify and prioritize the actions/activities in the coming years.
- This initiative will refine Africa's needs and capacities in particle physics in order to present them as Letters of Interest (LoI).
- Subsequent sessions are planned to emerge with a collective strategy of physics (including particle physics).

What should the international HEP community do with Africa?

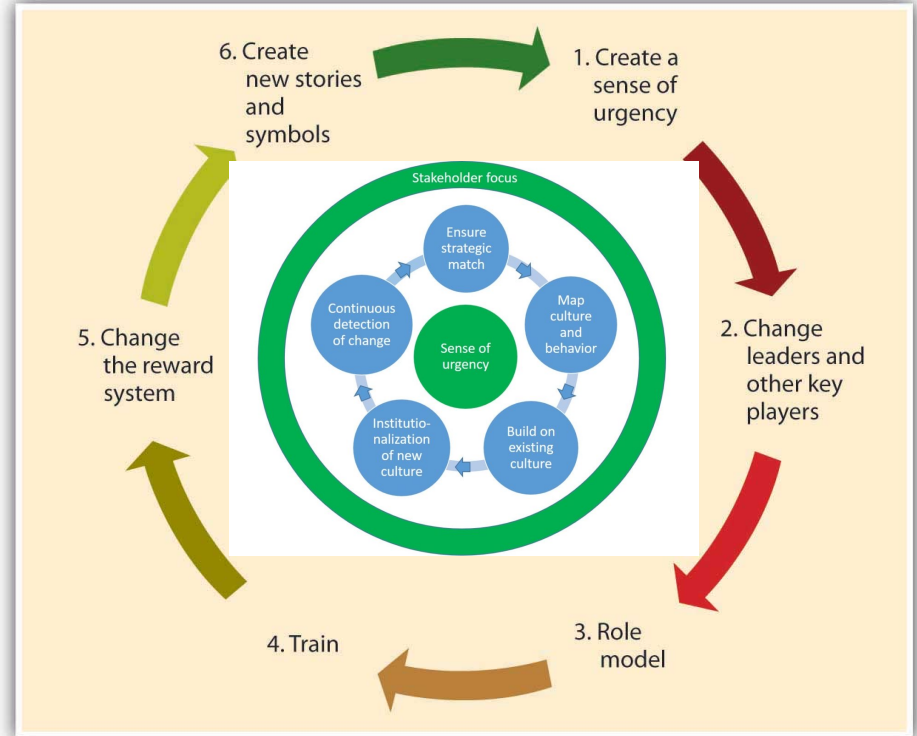
Definitions and context

- Cultural change

“Cultural change is the process in which an organization encourages employees to adopt behaviors and mindsets that are consistent with the organization's values and goals.” - <https://www.gartner.com/en/human-resources/glossary/cultural-change>

“Creating Culture Change”, section 8.4 from the book [Management Principles](#) (v. 1.0)

Mason Carpenter, Talya Bauer, Berrin Erdogan



Definitions and context

Structural change

- Structural change refers to transformative and impactful change that completely alters the way an organization functions. Structural change follows the organization strategy.

strategy+business

Is Your Culture Ready for Structural Change?

<p>COMPLACENT ORGANIZATIONS THAT DON'T MAKE STRUCTURAL CHANGES UNTIL A CRISIS HITS have three distinguishing culture-based tendencies.</p> <p>THEIR LEADERS:</p> <ul style="list-style-type: none">• Overemphasize "cascaded objectives" that often conflict.• Rely excessively on "can-do spirit" as a plan of action.• Exhibit unwarranted confidence in their own prescience and planning capabilities.	<p>COMPANIES THAT ADJUST THEIR STRUCTURE AHEAD OF A CRISIS exhibit three distinctive patterns of behavior driven by culture.</p> <p>THEIR LEADERS:</p> <ul style="list-style-type: none">• Track management's allocation of resources against key strategic priorities.• Make clear to everyone throughout the company that the truth is not only welcome, but expected.• Ensure that the company's goals are aligned with its talent, capabilities, and know-how.
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Source: strategy-business.com/culturereadyforchange
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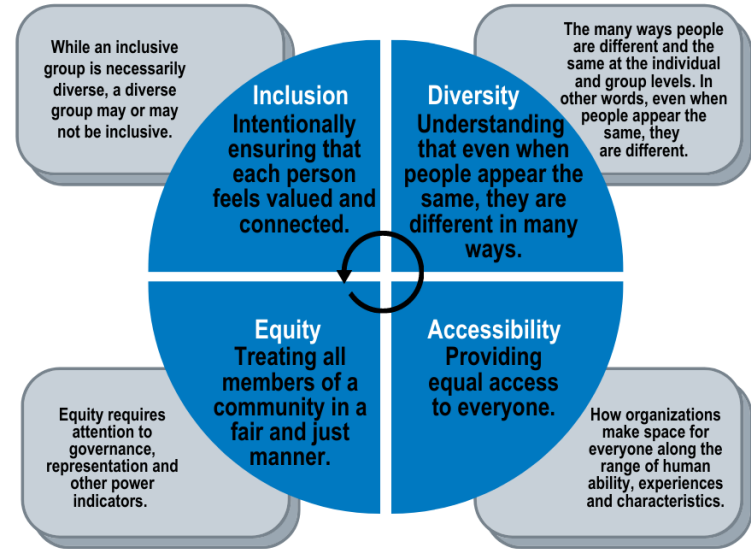
pwc | **strategy&**

Definitions and contexts

Equitable access for success

- Creating opportunities throughout the value chain
- IDEAS – Inclusion, Diversity, Equity, Access, Success

Success – the output of DEIA



Lessons from Snowmass 2021

- These Snowmass contributed papers are of particular interest in today's talk
- I strongly recommend anyone interested in the topics of Diversity & Inclusion, Public Engagement and Public Education, and Physics Education, to study these white papers and their recommendations.
- - Why should the U.S. care about high energy physics in Africa and Latin America? [arXiv:2203.10060](https://arxiv.org/abs/2203.10060)
 - The Necessity of International Particle Physics Opportunities for American Education [arXiv:2203.09336](https://arxiv.org/abs/2203.09336)
 -
 - The need for structural changes to create impactful public engagement in US particle physics [arXiv:2203.08916](https://arxiv.org/abs/2203.08916)
 -
 - Building a Culture of Equitable Access and Success for Marginalized Members in Today's Particle Physics Community [arXiv:2206.01849](https://arxiv.org/abs/2206.01849)

Cultural and structural change at all levels within the international HEP community and its stakeholders is necessary for an equitable access and success of Africa's HEP community.

Cultural and Structural Changes needed at international HEP community

- Partnership with existing HEP activities in Africa,
- Participation in the co-creation of regional HEP strategies,
- Championing and advocating for sustainable HEP programs in Africa,
- Support for Africa to host big HEP events, such as big conferences,
- Creating conducive environment for African HEP scholars and students at international HEP facilities and institutions – a sense of belonging,
- Creating opportunities and access for African scholars and students to HEP programs, facilities and events,

Cultural and Structural Changes needed at international HEP community

- Engage with Africa in a mutual beneficial way,
- Measure the impact by the success of African scholars and students,
- Measure the success by the return of African scholars and students to develop HEP programs in Africa,
- International HEP community should be led by transformative leaders,
- Opportunities and conducive environment should be created for African HEP scholars and students to participate in decision making structures of international HEP community,

The international HEP community is welcome to participate and co-create the future of Africa's HEPA community



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- Nuclear and Particle Physics
- Medical and Radiation Physics
- Biophysics
- Physics Education, Outreach, & Communication
- Diversity Equity & Inclusion in Physics
- Condensed and Material Physics
- Photonics
- Applied and Industrial Physics
- Theoretical and Computational Physics
- Physics for Sustainable Development
- 100 Years of Physics in Africa and the Future

Activities

- Workshops for High School Teachers
- Outreach for Secondary Schools
- Physics Lectures and Tutorials for Students
- Forums to Discuss Capacity Development & Retention




**100 years of
Physics in Africa
Past, Present, And
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Gqeberha (Formerly Port Elizabeth)













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**Date:
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