

Snowmass2021 Letter of Interest : Cultivating Math and Science in Africa

Samuel Meehan¹, Claire David², Lucílio Matias³, Kétévi A. Assamagan⁵, Katherine Dunne⁴, and Gopolang Mohlabeng⁵

¹CERN

²York University

³Karolinska Institutet

⁴Stockholm University

⁵Brookhaven National Lab

Thematic Areas:

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Contact Information:

Samuel Meehan: samuel.meehan@cern.ch

Abstract: Particle physics is a global community, yet nearly all nations in the entire continent of Africa do not participate. We propose to use snowmass as a means by which to more fully integrate individual and institutional involvement of Africa in our community.

When one examines a “map of particle physics” (e.g. membership within ATLAS¹ or CMS²) it is evident that our field is incredibly global and geographically diverse. Yet at the heart of these maps is a vast hole when examining the African continent - remarkably few African nations are home to universities participating in international collaborations. At the same time, Africa is the second largest continent in terms of population and by 2050, as we approach the end of the “30 year vision” that we are currently planning, its population will be greater than Europe, Latin America, North America, and Oceania combined³. If the status quo of African involvement in particle physics is maintained, this will be an ever-worsening intellectual injustice as well as a failure of the community which itself is detrimental to the success of the community by neglecting the incredible potential for impactful contributions to our success.

It is important to recognize that throughout Africa there is ongoing participation in large scientific collaboration by individual institutes. The ATLAS collaboration has participating institutions from both South Africa and Morocco and CMS has participation from Egypt. This participation is often facilitated through networks such as the Egyptian Network for High Energy Physics⁴ that allow multiple small institutions to pool resources and benefit from their shared interest, allowing them to meet the financial requirements (i.e. maintenance and operation costs) which accompany many particle physics collaborations. It further allows individuals from those countries to more easily affiliate with and join ongoing projects. Beyond this, there are leading initiatives that are hosted in Africa, such as the square kilometer array radio telescope⁵ in Southern Africa that have unique abilities to provide insights that are critical for the global intellectual advancement. Initiatives such as these demonstrate that there exists institutional support and desire for advancing science. However, there are persistent challenges throughout the continent, particularly in Central and West Africa, to provide support and conduits for individuals living in those nations to become involved in our community. There is little to no intellectual mobility for these individuals, particularly in a structured way that can broadly reach the ever-growing population of the continent.

There do exist some initiatives which exist to mitigate this injustice. Established in 2010, the African School of Fundamental Physics (ASP)⁶ is an educational workshop which takes place at centers throughout Africa every two years and brings lecturers from around the world to provide introductory lectures to graduate level students. This is rather similar to the European School of High Energy Physics (ESHEP)⁷ or the CERN-Fermilab Hadron Collider Physics Summer School (HCPSS)⁸, both of which take place annually. Moreover, the curriculum of the ASP has evolved during the course of its life to more broadly encompass diverse domains of fundamental physics as compared to ESHEP or HCPSS. Beyond these short-term educational programs, there also exists a persistent commitment to the institutional intellectual development of Africa from organizations such as the African Institute for Mathematical Sciences (AIMS)⁹ as well as the International Center for Theoretical Physics (ICTP)¹⁰, both of which function to provide resources for researchers as well as a conduit for students wishing to pursue careers in physics and/or academia. In particular, the long-term goal of AIMS is to create a sustainable pan-African academic network similar to that which exists in Europe or North America. Unfortunately, the reach of all of these established programs is limited and accessible to only a tiny fraction of the African population. Moreover, even if an individual is supported and affiliated in some way with one of these programs, there exist enormous financial and

¹<https://atlas.cern/discover/collaboration>

²<https://cms.cern/collaboration/cms-institutes>

³<https://population.un.org/wpp/Publications/Files/WPP2017KeyFindings.pdf>

⁴<https://indico.cern.ch/event/706657/>

⁵<https://www.skatelescope.org/>

⁶<https://www.africanschoolofphysics.org/>

⁷<http://physicschool.web.cern.ch/ESHEP/default.html>

⁸<https://hepss.fnal.gov/>

⁹<https://nexteinstein.org/>

¹⁰<https://www.ictp.it/>

structural barriers to pursuing a career in physics outside of Africa which are currently mitigated largely by individual intervention and support on the part of single scientists. This approach is not sustainable.

This Letter of Intent proposes to survey and study the official programs that are established in Africa as well as understand the informal avenues by which African students coming from nations with no ongoing particle physics research can pursue a career in our field. There is specific interest among the authors to understand how to increase networking in Africa in the domains of theory and accelerator physics. We will examine the role that the United States plays in this, both on the part of academics and governmentally and/or institutionally organized programs (e.g. NSF-PEER program¹¹ or APS support for developing nations¹²). Finally, we will design and propose further programs that will aim to increase international collaborations with African scientists by seeding a broader community of particle physics on the continent and growing networks between Africa and the United States.

¹¹https://www.nsf.gov/funding/pgm_summ.jsp?pi_ms_d=504726

¹²<https://www.aps.org/programs/international/programs/>