

APhRICA: excellence through training and intra-African mobility

Framework and objectives

APhRICA (Advanced **P**hysics **t**rainIng and **C**ollaboration with **A**frica) is a training Program devised by Dr. Andrea Marini (CNR, Italy), Dr. Matteo Gatti (CNRS, France), together with Prof. George Amolo and Dr. Michael Atambo (Technical University of Kenya), Dr. Benjamin Victor Odari (Masinde Muliro University of Science and Technology), Dr. Kiptiemoi Korir Kiprono (Eldoret University) and Prof. Catherine Meriàux (ICTP-EAIFR Director).

The Program is an extension of the Scientific Operational Agreement (**Advanced Physics in Rwanda Ism Collaboration Agreement**, June 2024) for research activities between **CNR** (Consiglio Nazionale delle Ricerche, Istituto di Struttura della Materia) and **ICTP-EAIFR** (East African Institute for Fundamental Research of the University of Rwanda, also category 2 UNESCO Institute), under the scientific responsibility of Dr. Andrea Marini, supported by Dr. Carmen Gargiulo. The project involves also teachers from excellent international research centers and universities (CNRS, EPFL, CECAM, École polytechnique, Sorbonne University).

APhRICA's goal is implementing advanced training in an intra-African system, beyond the current training schemes based on the attendance of basic courses at ICTP-EAIFR and organisation of one-shot events like summer schools. APhRICA promotes international collaborations and networking activities to strengthen local capacity and mitigate brain drain. APhRICA attracts top-level graduate students in the East African region through a rigorous selection to carefully assess their initial knowledge and abilities.

Methodology and application

After the launch in July 2024 at the **TU-K** Technical University of Kenya, in Nairobi, interest in the initiative grew, attracting applicants from over 10 African universities (mostly from Kenya, but also from Nigeria, Tanzania, Sudan and other countries).

The STEM sectors that are involved in the APhRICA activities are:

- mathematical methods for computational and theoretical physics as well as engineering
- theoretical and applied Physics for materials science research
- computational methods for materials.

The APhRICA initiative is supported by champions from Europe. In particular, Dr. Marini is the founder of the [Yambo project](#), a scientific software that is currently participating in the transition to exascale computers funded by European Commission. Yambo is installed in several High-Performance Computing centres in the world, including South Africa NICIS, KENET's GPU cluster and NACOSTI's STAMPEDE system in Kenya. Yambo has been used to train students all [over the world](#).

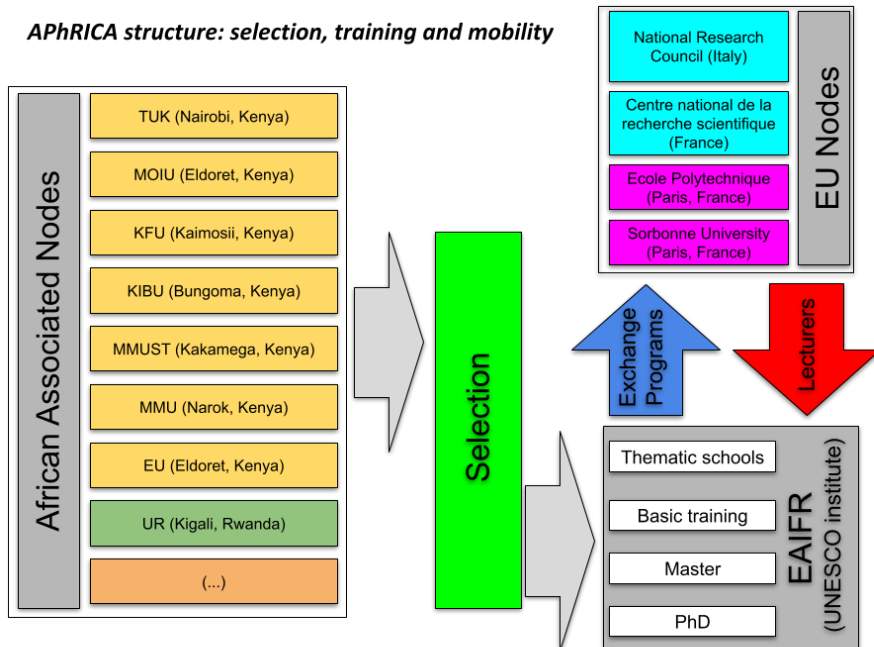
APhRICA is an intra-African initiative. While European lecturers travel to Africa, students are supported to move within Africa. Moreover, APhRICA trains students and lecturers, too. This is because the goal is to have, in five to six years, African lecturers training African students all over the programme. Below one of the lectures held (Nairobi, July 2025).



APhRICA is a two-year long training programme that combines 8 two-weeks (80 Hrs each 2 weeks), intensive courses together with online activities for the entire duration of the programme. Every year APhRICA selects a group of students (their number is presently limited by funding availability). The students are hosted by the East African Institute for Fundamental Research (EAIFR) in Kigali, Rwanda. EAIFR, as a category 2 UNESCO Institute, implements high level [UNESCO compliant training standards](#) (Campus Africa).

At EAIFR the students receive, for two years, basic mathematical and conceptual training. Each year, thus twice for each student, APhRICA organises advanced schools where the students are taken, step by step during two intensive weeks of face-to-face training, up to the cutting edge of the field. See also the detailed structure of the project, below.

APhRICA structure: selection, training and mobility



Thus, an APhRICA two-year cycle is organized as follows:

- YEAR 1 (EAIFR): first series of basic courses like quantum and statistical mechanics
- End of YEAR 1 (different locations): advanced school on Density Functional Theory
- YEAR 2 (EAIFR): second series of basic courses like many-body theories
- End of YEAR 2 (different locations): advanced school on computational physics.

At the end of the second year APhRICA is also planning to offer to the most brilliant students' opportunities to continue training through research, including bursaries to visit laboratories in Europe. There is a deliberate will to include female students in the selection to address concerns of gender (see below a photo of an event recently held at the Technical University of Kenya, 30th June – 11th July 2025).



After the first 2 selections (1st and 2nd Cohort) for the 2024-2026 and 2025-2027 APhRICA cycles, APhRICA is now organizing schools in Rwanda and in Kenya for year 1 and year 2 students, with almost 30 students and lecturers from different countries who study together for a two-week intensive experience and in turn, they

promote the teachings in their university contexts. See below the participants and staff of the QMI and QMII courses held in Kigali in Dec. 2025.



Impact and outcomes

The APhRICA programme's goal is to train excellent African students, providing them with the skills to perform world class research. This level of training in advanced theoretical, mathematical and computational physics is still lagging, a gap that can be an anchor program focus area to promote science aimed at addressing Africa's developmental challenges.

APhRICA makes it possible to bring the most brilliant physics students, African Early Career Researchers (ECR) as well as existing faculty, together. We believe that this will make a measurable impact in the advancement of Africa's STEM agenda and long term STI outcomes. It is expected that the following outcomes will be attained in the medium term:

- a) Enhancement of curricula in Physics and Mathematics in the participating institutions,
- b) Development and signing of institutional MoUs and exchange of students/faculty,
- c) Increased networking of researchers within the African continent.

As a best practice, APhRICA is an innovative training model that can seamlessly be extended to other domains and regions in Africa and also potentially able to be transferred to other developing areas.

More details:

<https://www.ism.cnr.it/it/ricerca/progetti/item/482-aphrica-advanced-physics-in-rwanda-cnr-ism-cooperation-agreement.html>

<https://www.cnr.it/it/news/13692/physics-without-frontiers-for-aphrica>

<https://flash-it.eu/aphrica/>

<https://eaifr.ictp.it/about/partnerships/>