African Strategy for
Fundamental and Applied Physics

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Astro-particle and cosmology potential in the Underground of Africa

There are signals from the Universe that one can detect by performing experiments which are not that large, not so costly and not even located in space or at large observatories on Earth. Some of these signals can address the following questions: How did the Universe begin? How did it come to existence? What is hidden to our eyes and observatory facilities? Such experiments in astro-particle physics and cosmology would explore dark matter searches, studies of radioactive decays, and neutrino physics. They require careful shielding against cosmic rays which has motivated the construction of laboratory caverns in mines and adjacent to tunnels under mountains. There are currently about a dozen such laboratories, in existence or under construction, all in the northern hemisphere, mainly in Europe, USA and Canada, China and Japan. To cite a few known facilities and their specificities:

- IceCube (Antarctica) https://icecube.wisc.edu : the longest particle detector in the world, was completed in December 2010. The purpose of this detector is to investigate high energy neutrinos, search for dark matter, observe supernovae explosions, and search for exotic particles such as magnetic monopoles.
- ANTARES (telescope) https://antares.in2p3.fr/: is a neutrino detector located 2.5 km under the Mediterranean sea along the coast of Toulon, France. It is designed to locate and observe neutrino flux in the direction of the southern hemisphere.
- XENON http://www.xenon1t.org experiment: is a dark matter direct search experiment located at the Gran Sasso National Laboratories and will be sensitive to WIMPs with SI cross section of 10-48 cm^2.
- BOREXINO https://borex.lngs.infn.it/ experiment: is a real-time detector, installed at Laboratori Nazionali del Gran Sasso, designed to detect neutrinos from the Sun with an organic liquid scintillator target
- NESTOR https://www.europarl.europa.eu/news/en/headlines/security/20140327STO40046/nestor-unravelling-the-universe-s-mysteries-from-the-bottom-of-the-sea Project: the target of the international collaboration is the deployment of a neutrino telescope along the sea floor of Pylos, Greece.
- Kamioka Observatory https://www-sk.icrr.u-tokyo.ac.jp/: is a neutrino and gravitational waves laboratory located underground in the Mozumi Mine near the Kamioka section of the city of Hida in Gifu Prefecture, Japan.
- Laboratori Nazionali del Gran Sasso https://www.lngs.infn.it/en/lngs-overview: is a laboratory that hosts experiments that require a low noise background environment. Located within the Gran Sasso mountain, near L'Aquila (Italy). Its experimental halls are covered by 1400 m of rock, which protects experiments from cosmic rays.
- SNOLAB https://www.snolab.ca/: this facility is Canada's deep underground research laboratory, located in Vale's Creighton mine near Sudbury, Ontario Canada. It provides an ideal low background environment for the study of extremely rare physical interactions. SNOLAB's science program focuses on astroparticle physics, specifically neutrino and dark matter studies, though its unique location is also well-suited to biology and geology experiments. SNOLAB facilitates world-class research, trains highly qualified personnel, and inspires the next generation of scientists.

The African continent is large and its landscape is so diverse that many places may qualify geologically and can host underground experiments requiring shielding against cosmic rays and radiations.
In this Letter Of Interest, we would like to address the opportunity for African countries to contribute to the enhancement of the knowledge and the understanding of the fundamental aspects of Nature and Universe in contributing to build and lead underground experiments. This way, they will have the chance to be involved in many aspects of science and society such as excavation, geology, technology and instrumentation, physics education and research. This will give the country and the researchers the opportunity to develop physics education, knowledge transfer skills and develop relations with local and regional industries and retain the physicists and the young people, thus improving employment.

Primary Category

Particle Physics

Secondary Category

Astrophysics & Cosmology

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