**The African Light Source : A Brighter Future for Africa**

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**Synopsis**: This communication provides insight into the current status and progress of the African Light Source Project (AfLS).

**Body**:

The confluence of new and diverse advances in science and technology has the potential to generate unprecedented opportunity for economic growth and societal transformation. For developing countries on the African continent, there is a growing need for innovation to address the wide range and often unique plethora of challenges that adversely impact the lives of many Africans today [1,2]. With a population of over 1 billion that is growing and projected to outpace the rest of the world in the next 100 years [3], the need for sustained and equitable development is ever more apparent and highlights the need for investment in science, technology and innovation. The scope of sciences that are needed can be united in a single large-scale research infrastructure.

An Advanced Light Source (AdLS) is a source of electromagnetic radiation that can generate exceptionally intense beams of X-rays, ultraviolet and infrared light which are significantly more intense than conventional sources.

Advanced Light Sources derived from either synchrotron or free-electron laser sources are an enabling tool for advancing knowledge that underpin innovation in virtually all fields of research and development. Amongst large-scale scientific infrastructures, light sources support amongst the widest and most diverse set of researchers, counting over 30,000 in Europe alone [4], and many thousands of researcher visits or remote access to each facility every year.

They are essential for the development and understanding of biological processes, advanced materials, soft matter, drug design, catalysts, electronic devices, structural engineering and heritage science [5-8]. In particular, light sources are important for the study of viruses and recently have played a pivotal role in understanding the SARS-CoV-2 virus that causes COVID-19 and is responsible for the recent global pandemic [9]. Light sources also have the added value of facilitating retention of talented early and mid-career scientists that recognise light sources as a key research tool for their development.

A large-scale infrastructure such as an Advanced Light Source can provide benefit to the entire African continent, not just the host country. This will include human capacity development, the development of local and regional infrastructure that is capable of both excellent research and able to act as feeder infrastructure for the Advanced Light Source, a competitive industry advantage that accrues from involvement in the light source, big data analytics capacity, innovation and other benefits that create wealth for all of Africa. No African country will be left behind.

Despite the near universality of the Advanced Light Source as a premier solution elsewhere, Africa is the only habitable continent that currently is not host to a light source. To drive innovation and to address Africa’s challenges, a repositioning needs to take place in order to establish an advanced light source instrument on the African continent [10]. The result will transform the scientific landscape in Africa, enable growth of competitive African industries, enhance university education, support training of and careers for new generations of young researchers, and ultimately address issues, challenges and concerns relevant to Africa.

The African Light Source project (AfLS), along with its partner organisations, is leading the drive towards establishment of the first light source on the African continent [11]. With a uniting and democratic vision for the African continent, AfLS also seeks to challenge the current dependence of African scientists on existing light sources and feeder facilities, while realising the potential of Africa to address many of its unique challenges.

The key enabling principle that is uniquely African is the *Ubuntu* approach which is best described as the embodiment of the ethical harmony of a person’s identity with their community or natural environment. It is centred around the values of inclusivity, fairness, tolerance, democracy, honesty, equity, consultation and empathy. This principle is a unifying force that beats at the heart of AfLS and Africa as a whole, primarily because the AfLS project represents an important step towards a more equitable African participation in global science accompanied by technological skills for innovation and growth. This view is shared by the majority of Pan-African organisations and was affirmed during the first African Higher Education Summit [12].

The AfLS governance structure consists of an International Advisory Committee and an Executive Committee that collectively fulfil the AfLS mission as outlined in the AfLS Roadmap [10]. There are several implementation committees for specific areas of the Roadmap. The Roadmap has community-driven components, such as capacity building, conferences and workshops, deep training through extended working visits to partner international synchrotrons, the growth of the African User base and also establishing the necessary research networks. There are also programmes that develop the local and regional research infrastructure and its access more broadly. The AfLS is also engaged in high level conversations with African governments, Pan-African organisations, science academies and national and Pan African professional bodies for each relevant discipline.

The AfLS has representation and support from countries and regions including Egypt, Ethiopia, Ghana, Nigeria, Rwanda, Senegal, South Africa, Zimbabwe, Caribbean, Europe, Japan, United Kingdom and United States.

The AfLS is not the only voice for a light source in Africa. There are other African organisations that overlap in this vision. This includes the African Union (AU), the African Academy of Sciences (AAS), the Network of African Science Academies (NASAC), many Pan African and African scientific professional bodies, voluntary associations and research organisations by discipline, several African Governments and other stakeholder organisations within and external to Africa.

The AfLS works with these organisations in this common goal. An important aspect is that the dominant funding for the AfLS should be derived from full participation of African Governments. It will take time to develop this level of understanding.

The SKA project, with significant African funding, as well as the strong and growing African participation in a variety of international large-scale infrastructures, such as CERN, Dubna, astronomical observatories and, of course, synchrotrons can be seen as a pioneering development of the African appetite and appreciation of its own premier large-scale research infrastructure, the AfLS. Some recent events, such as the current pandemic, have highlighted the importance of each continent to have its own intellectual property in the development of medical interventions. This would have facilitated, for example, the necessary equitable global nature of the vaccination programme.

A significant milestone along the AfLS roadmap is the completion of the Conceptual Design Report (CDR) and Technical Design Report (TDR) documents that articulate the need and potential designs for the light source.[13] The intended audience for the CDR includes policymakers, politicians, academics, engineers, technicians, business persons, industrialists, financiers, strategic thinkers, potential stakeholder organisations and the general public. The CDR is currently in preparation by the international writing team as appointed by the AfLS Executive Committee and is scheduled for publication later in 2022. It is accompanied by widespread inclusive solicitation of input and participation from Africa and also any interested person abroad. Completion of the CDR will facilitate concrete dialogue with the African Union, African governments, Pan-African organisations, and relevant national and international organisations regarding the choice of design and potential location of the light source facility.

Light sources are proven to provide tremendous benefit to socio-economic development within and beyond their host countries and are revolutionising a broad range of fundamental and applied sciences. The advent of an African light source, driven forward by the special Ubuntu heart of Africa, will herald a new and brighter future for Africa that is long overdue and much needed.

**Conflicts of Interest**:

All authors declare that they have no conflicts of interest in publishing this work.

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