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NUPHAPHA-Nuclear Photonics Accelerated Physics for Africa

Abstract: Embracing nuclear photonics enabled by accelerators can play a key role in accelerating capacity building in both nuclear (basic and applied) and laser physics in Africa that would likely lead to a revision of African Union's Agenda 2063 of the strategic framework for sustainable development and economic growth based on nuclear science and technology.

Introduction
Today more than 20,000 particle accelerators are operating world-wide. As reviews of their landscape and future will be taking place this May [1] at the first IAEA International Conference on Accelerators for Research and Sustainable Development the renaissance in nuclear physics wrought by new high-power, short-pulse lasers and novel sources highly brilliant, intense gamma ray beams will continue to open up unprecedented perspectives for applied photonuclear physics [2]. These dynamics of the developments are good but present the danger that the research gap in accelerator physics between North and South, large as it already is, will widen even further.

Nuclear Photonics
Born in 2010 nuclear photonics uses the unique capabilities of two disciplines namely heavy ion physics and physics of super-strong laser fields to fashion out a new cross-disciplinary field of Physics and Engineering applying controlled photo-nuclear reactions with artificial γ-ray beams.

With the new low-energy, pulsed, polarized neutron beams of high intensity and brilliance [3] as well as new positron sources with significantly increased fully polarized brilliance [4] radically new clinical applications are expected in the use of radioisotopes [5], non-invasive tomography and microscopy, management of nuclear materials and nuclear forensics, and materials science. If as expected a seeded quantum FEL for γ beams becomes possible, with much higher brilliance and spectral flux, the nuclear resonance fluorescence (NRF) method will be boosted drastically.

Most of these developments are taking place at the Extreme Light Infrastructure –Nuclear Physics (ELI-NP) in Bucharest (Romania), MEGaRay in Livermore (USA), NICA (Nuclotron based Ion Collider fAcility) in Dubna (Russia) and the IγS facility at Duke University (USA). At Nuclear Research (Dubna) the NICA (Nuclotron based Ion Collider fAcility) will soon be used to study the properties of dense baryonic matter [6-9].

The Proposal: NUPHAPHA
We propose in this LOI a conceptual academic-industry partnership in Africa to act as a contact point for large group participation in nuclear-photonics research world-wide initially concentrating on the already homegrown topics of (i) Laser Physics and (ii) Radiation Physics and Applied Nuclear physics. International cooperation is the core of today's successful scientific culture. For instance about 2000 specialists from 90 institutes of 26 countries of the world take part in the creation of the NICA collider. Such networks are not well developed in Africa, the most rapidly developing region in the world and with the greatest educational/scientific needs. This North-South divide deprives the global research community of the substantial intellectual capital located in Africa and hinders the effectiveness of our collective scientific responses. NUPHAPHA will be part of the structural initiative to address the imbalance. Networks are a proven modern way of organizing knowledge production processes.

Although the dismal state of laser-related research on the African continent is well documented [10] this initiative could be co-coordinated by ALS at CNRS and iThemba LABS in South Africa (the pre-eminent laboratory in the African continent for nuclear physics research) to:
• Steer a continental capacity building initiatives
• Coordinate human capital mobility in nuclear photonics within Africa and across borders
• Promote and optimize R&D infrastructure sharing in the continent
• Pool resources through various North-South and South-South research cooperation
• Improve access to the scientific research Infrastructure that is available in the North

• Initiate linkages of scientists and institutions committed to nuclear photonics
• Identify and promote adoption of best practices in accelerator technology transfer

Conclusion
The NUPHAPHA initiative and research partnerships are envisaged to break old patterns for real change. The research groups and networks involved in NUPHAPHA should agree to exchange scientists and experts as well as mount joint projects within working groups.

References

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Primary Category

Nuclear Physics

Secondary Category

Optics & Photonics

Subgroup categories

NuclearPhysics-NuclearApplications

Did you / will you submit this LOI to another category?

NO

Additional Information

Relevant also for accelerator physics

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