African Futures Mentor Application
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Mentors should have a specific research project to engage the early career scholar. The proposal should provide a brief overview of the research, publication or grant proposal writing work that will be conducted, which of the AAP priority areas that will be addressed, and the specific work activities that the early career researcher will be expected to perform (1 page).

Overview of research, publication and grant proposal

The proposed research focuses on the validation of physics models used to treat nuclear reactions involving rare isotopes at NSCL/FRIB and that are implemented in the Geant4 Monte Carlo simulation toolkit (www.geant4.org). The results from this research will be presented at conferences, and published in at least one article in a peer-reviewed journal. The candidate is also expected to spend a significant fraction of the time at UCAD to implement the experimental activities associated with the proposed work and possibly supervise one or more students. The first set of experiments will be based on the acquisition and modeling of the Rutherford scattering experiment system from Leybold (https://www.leybold-shop.com).

AAP priority area

The proposed project is aligned with the following priorities of AAP: "Water, Energy, and the Environment" and "Education".

Specific work activities of the early career researcher

The proposed work will consist of:

- Development and validation of a Geant4-based code for low energy nuclear physics. This work is to primarily provide a benchmark for coding purpose and allow the training of students locally in the use of the Geant4 Monte Carlo toolkit using low activity sources (beta, gamma and alpha) and the Rutherford scattering experiment. This work entails:
    - Performing attenuation experiments (through air and thin materials) with sources and compare with Geant4 simulations; and
    - Performing Rutherford scattering experiments with different foils and sources and compare with Geant4 simulations.
- Development of a Geant4 validation suite specifically tailored to neutron rich nuclei. The corresponding hadronic physics in the current version of Geant4 (10.5) includes amongst others various models for elastic and inelastic reactions, fragmentation, fusion and fission, break-up, abrasion-ablation and electromagnetic dissociation. This work entails:
    - Identifying the various models suitable for (neutron rich) rare isotope physics;
    - Performing a comparative study for specific processes to assess their validity;
    - Developing a validation suite for this work to provide an automatic testing of models; and
    - Participating in and reporting at weekly meetings with the MoNA Collaboration.