Investigation of neutron-rich Po-Fr nuclei lying in the south-east frontier of the Island of Octupole Deformation around mass 225

Research Project / Research Group Description:
The gamma-ray and neutron spectroscopy group of IFIC has a long-standing track record on experimental nuclear physics exploiting neutron and gamma-ray spectroscopy methods, with a main focus on nuclear astrophysics, nuclear structure, and applications. We carry out forefront research activities in leading facilities in the framework of international collaborations such as BRIKEN and KISS at RIKEN, DESPEC at FAIR, ISOLDE and NTOF at CERN, etc. The group also has a strong track record in the development of advanced instrumentation for nuclear research and applications, such as neutron counter arrays (BELEN and BRIKEN), total absorption spectrometers (LUCRECIA, ROCINANTE and DTAS) and gamma-ray detectors with imaging capabilities (i-TED and GUALI).

We propose a thesis project focused in on the study of the beta decay of exotic neutron-rich nuclei of Po and Rn. These nuclei lie in the frontier of the so-called "island of octupole deformation" around Z~88 and N~134, characterized by nuclei with pear-like shapes. Their study will help to better determine the octupole degree of freedom and the interplay between quadrupole and octupole correlations at the far end of the island. The experiment has recently been approved with the highest priority by the program advisory committee of GSI for the "Phase 0" of FAIR among more than 60 high-quality proposals presented by renowned international groups. The work will be carried out within the Decay SPECtroscopy (DESPEC) collaboration of NUSTAR-FAIR, starting by the end of 2018.

Job position description:
The successful PhD candidate will participate in first-class research at leading facilities in experimental nuclear physics (FAIR, RIKEN, CERN, GANIL, etc…). In particular, she/he will be in charge of the preparation, data taking, and data analysis of the experiment mentioned above. Main tasks include beam-transport simulations to optimize the production and identification of the heavy exotic fragments, GEANT4 simulations to optimize the performance of the beta-decay station, tests of detectors and electronics, detector commissioning, development of root/c++ based programs for the near-line and off-line analyses, interpretation and dissemination of results, etc.

Main objectives to be achieved include the determination of beta-decay half-lives relevant to understand the formation of the heaviest chemical elements through the r process of explosive nucleosynthesis, the construction of new decay schemes, and the measurement of lifetimes of excited nuclear states to determine transition strength probabilities, which are required to assess the degree of octupole deformation in these nuclei. At the end of her/his PhD, the student will have acquired the necessary autonomy and skills to carry out successful research in this area and/or related fields.

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