

New half-lives measurements for r-process in $A \sim 225$ Po-Fr nuclei

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The astrophysical rapid-neutron capture process (r-process) of explosive nucleosynthesis is responsible for the formation of half of the heavy nuclei above Fe [1]. Actinides are produced towards the end of this process, when the neutron flux is expected to be minimal, and it is supported also by fission processes. Given that the r-process path runs far away from the accessible species, in this heavy region of the chart of nuclides, experimental inputs on β decay for nuclei beyond $N=126$ are particularly useful to test predictions of global nuclear models.

In this paper results from a recent experiment performed at GSI-FAIR (Darmstadt, Germany) within the HISPEC-DESPEC experimental campaign, as part of the FAIR Phase-0 program, will be discussed. The experiment populated $220 < A < 230$ Po-Fr nuclei in a relativistic fragmentation reaction induced by a 1 GeV ^{238}U beam. The species were selected and identified using the FRagment Separator (FRS) and implanted in the DEcay SPEcTrosCcopy (DESPEC) station [2] to study their subsequent β decay. The DESPEC station is composed of a stack of Double Sided Silicon-Strip Detectors (DSSD) sandwiched between two plastic scintillator detectors, surrounded by a hybrid γ -detection array consisting of high-resolution HPGe and fast timing LaBr₃(Ce). The extracted β -decay half-lives are discussed with the help of recent theoretical models to assess the impact of the measured values in the predictions of the r-process. Perspectives of future measurements in the region will be provided.

[1] M.R. Mumpower et al., Prog. Part. Nucl. Phys. 86 (2016) 86;

[2] A. K. Mistry et al., Nucl. Instrum. Methods Phys. Res. A 1033 (2022) 166662

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