

# Measurements of $\beta$ -delayed neutron emission probabilities around the medium-mass mid to the doubly-closed shell region

Friday, July 26, 2024 11:40 AM (20 minutes)

Beta-delayed neutron emission ( $\beta n$ ) is the prevalent decay mode in very neutron-rich nuclei that are involved in the nucleosynthesis via rapid ( $r$ -) neutron capture process [1]. Characterized as a two-step decay mechanism, it involves  $\beta$ -decay feeding into excited states beyond the neutron separation energy in the daughter nucleus, succeeded by neutron emission, resulting in a lower-mass nucleus. The probabilities of  $\beta n$  ( $P_{\beta n}$  values) are intricately tied to factors such as  $Q_{\beta n}$  windows, decay strength distribution, de-excitation, and neutron emission models [2], emphasizing the critical need for precise experimental data on  $\beta n$  emitters. Such data not only deepen our understanding and modeling of  $\beta n$  processes but also serve as vital inputs for nucleosynthesis models. Yet, a dearth of reliable experimental information persists, particularly regarding multi-neutron emission channels process [3]. In this contribution, we will present recent experimental results on the  $P_{\beta n}$  values, with a focus on the neutron-rich mid-shell region around mass  $A=110$  and around doubly-closed shell region at  $^{132}\text{Sn}$  [4]. The experiments were conducted within the BRIKEN project at RIKEN RIBF, an extensive survey program of the  $P_{\beta n}$  values. The systematic of the results shows discernible odd-even and shell effects, underscoring the sensitivity of  $P_{\beta n}$  values to nuclear structure information and their important role in benchmarking theoretical models. Additionally, we will introduce a new experimental program at RIKEN's RIBF, employing neutron time-of-flight and  $\gamma$ -ray spectroscopy setups in tandem with MRTOF mass measurements, aimed at further elucidating the  $\beta n$ .

This work is supported by the U.S. Department of Energy, National Science Foundation, JSPS, Spanish Ministerio de Economía y Competitividad, UK Science and Technology Facilities Council, National Research Foundation (NRF) in South Korea, Polish National Science Center, Natural Sciences and Engineering Research Council of Canada (NSERC).

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**Session Classification:** Decay Spectroscopy