

Measuring the half-life values for exotic rare-earth isotopes

S. Kovács¹, A. Vitéz-Sveicz^{1,2}, G. G. Kiss², A. Tarifeno-Saldivia³, M. Pallas³ on behalf of the BRIKEN collaboration

¹ University of Debrecen, H-4032 Debrecen, Egyetem tér 1, Hungary

² Institute for Nuclear Research (ATOMKI), H-4026 Debrecen, Bem tér 18/c, Hungary

³ Universitat Politècnica de Catalunya (UPC), E-08028 Barcelona, Spain

The observed abundance distribution of the r-process is dominated by two distinctive maxima at masses of $A \approx 130$ and $A \approx 195$ which are associated with neutron shell closing. However, a smaller peak called the rare-earth abundance peak (REP) around $A \approx 160$ originates from freeze-out during the late phases after neutron exhaustion. This provides a unique probe of the astrophysical conditions in the latter stages of the r-process [1].

According to sensitivity studies the most influential nuclei to the REP formation can be found in the $A \approx 160$, $55 \leq Z \leq 64$ neutron rich region [2]. For this reason, in recent measurements at RIKEN Nishina Center using the AIDA-BRIKEN array, the decay parameters (delayed neutron emission probability and half-life) of 28 exotic neutron-rich Pm-Sm-Eu and Gd isotopes were measured. The half-life values of the isotopes were obtained by fitting the time distribution of implantation-beta ($i\text{-}\beta$) correlation events using a sum of Bateman formulae [3]. The two CLOVER-type HPGe detectors included in the BRIKEN array for γ spectroscopy, are used to measure γ -spectra, thus the $i\text{-}\beta$ half-life results can be verified by exponential fitting the time distribution of implantation-beta-gamma ($i\text{-}\beta\text{-}\gamma$) correlation events [4]. Additionally, level schemes can be constructed in this region using the $i\text{-}\beta\text{-}\gamma$ events.

Details on the analysis methods as well as the first results (half-lives from $i\text{-}\beta\text{-}\gamma$ events, level schemes) will be presented.

[1] M. R. Mumpower *et al.*, ApJ. **752**, 117 (2012).

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

[3] G. G. Kiss *et al.*, in preparation

[4] A. Tolosa-Delgado *et al.*, Nucl. Instr. Meth. **925**, 133 (2019).