NUSTAR monthly Seminar

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New half-lives and β-delayed neutron branchings for neutron-rich Ba to Nd nuclei (A~160) relevant for the formation of the r-process rare-earth peak

Rapid neutron capture nucleosynthesis (the r-process) produces nearly half of the nuclei heavier than iron in explosive stellar scenarios. The solar system r-process residual abundances show two peaks located at A ~ 130 and A ~ 195. Between these peaks lies the Rare-Earth Peak (REP), a distinct but small peak at mass number A ~ 160 that arises from the freeze-out during the final stages of neutron exposure. According to theoretical models and sensitivity studies, half-lives ($T_{1/2}$) and β-delayed neutron emission probabilities (P_{xn}) of neutron-rich nuclei, in the mass region A ~ 160 for 55≤Z≤64 are critical for the formation of the REP [1,2]. The BRIKEN collaboration [3] conducted an extensive measurement program of β-decay properties of nuclei involved in the r-process at the Radioactive Isotope Beam Factory (RIBF) located in the RIKEN Nishina Center, Japan. The BRIKEN-REP experiment has measured $T_{1/2}$ and P_{1n} of nuclei from Ba to Eu (A ~ 160), belonging to the region that is the most influential to the REP formation [4,5]. In this contribution, we will present the experimental results of new $T_{1/2}$ and P_{1n} branchings within the Ba to Nd region. Furthermore, we will discuss how these new experimental data trends match with the trends from recent nuclear model calculations used for r-process simulations of the REP.

[1] M. R. Mumpower et al , Phys. Rev. C 85, 045801 (2012).
[2] A. Arcones and G. Martinez Pinedo , Phys. Rev. C 83, 045809 (2011).
[3] J.L. Tain et. al , Acta physica polonica B 49(03), 417 − 428 (2018).
[4] G. G. Kiss, et al., The Astrophysical Journal 936 2, 107 (2022).
[5] A. Tarifeño-Saldivia et al , RIKEN Accel. Prog. Rep. 54, 27. (2021).

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