



国立研究開発法人理化学研究所 仁科加速器科学研究センター
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RIKEN Nishina Center for Accelerator Based Science
The 318th RIBF Nuclear Physics Seminar

β -delayed one and two neutron emission probabilities
and the nuclide abundances around the second r-process peak

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The nucleosynthesis of elements heavier than iron via the rapid (r-) neutron capture process occurs as a sequence of neutron captures and β -decays in very neutron-rich region of nuclear chart. Among the nuclear properties of neutron-rich nuclei that are important in determining final r-process abundances, the β -delayed neutron emission probabilities play important roles that smoothen the odd-even staggering pattern and change the amount of neutrons during the freeze-out of neutron captures [1]. In this seminar, the latest and upcoming results from the “Beta-Delayed Neutrons at RIKEN” (BRIKEN) project, which aims at surveying the β -delayed neutron emission probabilities of very neutron-rich nuclei relevant to the r-process nucleosynthesis, will be showcased. As a highlight of the BRIKEN project, the β -delayed one- and two-neutron emission probabilities (P1n and P2n) of 20 neutron-rich Ag, Cd, In, Sn isotopes were measured [2]. The nuclear shell effects around doubly-magic ^{132}Sn were manifested in the systematic of the measured P1n and P2n values. Our results also provided important benchmarks for the newly developed macroscopic-microscopic and self-consistent global models [3, 4] with inclusion of the statistical treatment of neutron and γ emission. Direct impacts of the measured P1n and P2n on the odd-even staggering of the final r-process abundance around the second r-process peak were demonstrated, where the observed odd-mass isotopic fractions of Ba in metal-poor stars [5] were found to be better reproduced by using our data.

[1] A. Arcones and G. Martínez-Pinedo, Phys. Rev. C 83, 045809 (2011).

[2] V. H. Phong et al., Phys. Rev. Lett. 129, 172701 (2022).

[3] P. Möller, M. R. Mumpower, T. Kawano, and W. D. Myers, At. Data Nucl. Data Tables 125, 1 (2019).

[4] F. Minato, T. Marketin, and N. Paar, Phys. Rev. C 104, 044321 (2021)

[5] C. Wenyuan et al., Astrophys. J. 854, 131 (2018).

* The talk will be given in English language.

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