

Study of neutron-rich systems 6H, 7H and 4n in 8He+d interactions at ACCULINNA-2

Tuesday, 25 February 2025 11:30 (20 minutes)

An experiment at the ACCULINNA-2 fragment separator was conducted using a 8He beam and a deuterium target to study neutron-rich systems 6H, 7H, and 4n [1, 2, 3]. This work provided comprehensive insights into their decay modes and interaction mechanisms. For 7H, we report the first experimental evidence of five-body decay. For 6H, sequential decay through 5H g.s. was established [4]. The 4n system was studied as a product of two independent transfer reactions, with low-lying structures observed at 3.5 MeV above the decay threshold. These findings align with the results of work [5].

The experiment relied on an efficient use of ultra-thin silicon strip detectors (20 μm) for precise detection of $\Xi=1,2,3$ isotopes across a wide energy range. The approach enabled detailed analysis despite the setup's limited neutron detection efficiency. This methodological framework is discussed in [5-9], including studies of 6H, 7H, and other isotopes, along with the optimization of charged particle detection at ACCULINNA-2.

Recognizing the experiment's limitations, simulations within the ExpertRoot framework [10] were performed to enhance the detection efficiency of reaction products. The results demonstrate that detector modifications can improve statistics for the studied systems by a factor of ~ 2.5 under identical beam parameters.

The presentation will detail experimental techniques, including the use of ultra-thin detectors, methods for particle reconstruction, and the impact of simulation-based optimizations. Key results and future perspectives for extending studies of neutron-rich systems will also be presented.

- [1] E. Yu. Nikolskii et al., Phys. Rev. C 105 (2022) 064605, <https://doi.org/10.1103/PhysRevC.105.064605>.
- [2] I. A. Muzalevskii et al., Phys. Rev. C 103 (2021) 044313, <https://doi.org/10.1103/PhysRevC.103.044313>.
- [3] I. A. Muzalevskii et al., Phys. Rev. C (2024), Submitted.
- [4] Duer et al., Nature 606 (2022) 678, <https://doi.org/10.1038/s41586-022-04827-6>.
- [5] I. A. Muzalevskii et al., EPJ Web Conf. 290 (2023) 09001, <https://doi.org/10.1051/epjconf/202329009001>.
- [6] E. Yu. Nikolskii et al., Phys. Atom. Nucl. 86 (2024) 923, <https://doi.org/10.1134/S1063778824010381>.
- [7] E. Yu. Nikolskii et al., Nucl. Instrum. Methods B 541 (2023) 121, <https://doi.org/10.1016/j.nimb.2023.05.043>.
- [8] A. A. Bezbakh et al., Phys. Part. Nucl. Lett. 20 (2023) 629, <https://doi.org/10.1134/S154747712304009X>.
- [9] I. A. Muzalevskii et al., Bull. Russ. Acad. Sci.: Phys. 84 (2020) 500, <https://doi.org/10.3103/S106287382004019X>.
- [10] ExpertRoot Documentation, <http://er.jinr.ru/>

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