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On the nature of beta-delayed neutron emission near 54Ca

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Beta-delayed neutron emission (beta-n) plays an important role in diverse areas of nuclear science, from nuclear reactors to astrophysical nucleosynthesis. Due to its complicated nature, modeling the beta-n process relies on the validity of Bohr's hypothesis of the compound nucleus (CN) [1]. Here, the decay of the excited nucleus, populated in beta decay, depends only on its spin, parity, and excitation energy and is independent of the formation process [2]. However, recent experimental work suggested evidence of non-statistical beta-n emission near doubly magic 132Sn [3]. Thus, it is essential to verify the foundations of CN in the context of beta decay with a broader spectrum of nuclei, which may result in the revision of beta-n models and will have various consequences for power generation and astrophysical applications.

In this contribution, I will present an experimental work studying the beta-n emission of 51,52,53K at the ISOLDE Decay Station (IDS). In coincidence with the beta decay of 51,52,53K, gamma-ray and neutron-time-of-flight (nTOF) spectra were measured using HPGe clover detectors and VANDLE-like array [4], respectively. We extracted the exclusive neutron-emission branching ratios from the unbound states of 51,52,53Ca, which were populated in beta decay, to the low-lying states in the corresponding residues 50,51,52Ca. The experimental findings were compared with the Hauser-Feshbach statistical model. The results of these comparisons were unexpected and continue to compel us to question existing theories of the process. We propose a model which links the beta-n emission with the nuclear structure.

[1] N. Bohr, Nature 137, 344 (1936).
[2] P. Hansen and B. Jonson, Beta delayed particle emission from neutron-rich nuclei, in Particle Emission from Nuclei, Vol. 3, edited by M. Ivascu and D. Poenaru.
[3] J. Heideman et al., Phys. Rev. C 108, 024311 (2023).
[4] M. Madurga et al, Phys. Rev. Lett 117, 092502 (2016).

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