

Study of the excited ^9Li core in ^{11}Li

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^{11}Li nucleus is one of the flagship drip-line nuclei in the field of nuclear physics. A spatially extended structure of neutrons in ^{11}Li , which is now widely known as “halo” structure, opened the very active field of research with unstable nuclear beams. ^{11}Li have the nature of Borromean.[1] In many cases, ^{11}Li is considered as a 3-body system of $^9\text{Li} + 2$ neutrons. However, recent theoretical studies pointed out that contribution of the excited ^9Li core can be significant. According to the interpretation of [2], the ground state of ^{11}Li has components which contain excited state of the core. In Ref [3], they showed that the E1 cluster sum rule value should be reduced by about 15% due to the ^9Li core excitation. Currently no experiment has succeeded in providing a direct information of the excited ^9Li core in ^{11}Li .

In this work, with the data of SAMURAI18 experiment, the quasi-free $^{11}\text{Li}(p,pn)^9\text{Li}^*$ reaction was employed to study the excited ^9Li core. Because of spin-parity constraints, the first bound excited state of ^9Li cannot contribute much and the 2nd state, which is unbound, can give the major contribution. Therefore, the ^9Li excited core will decay into the $^8\text{Li} + \text{neutron}$. Using the invariant mass spectrum and dalitz plot of $^8\text{Li} + 2$ neutrons, we could get the direct information of the excited ^9Li core in ^{11}Li .

[1] M. V. Zhukov, et al., Phys. Rep. 231, 151 (1993).

[2] G. Potel, F. Barranco, E. Viguzzi, and R. A. Broglia, Phys. Rev. Lett. 105, 172502 (2010)

[3] Y. Kikuchi, et al., Phys. Rev. C 87, 034606 (2013).

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