Clustering Effects in $^{41,45,49}Ca^{*}$ Formed in Neutron Induced Reactions

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The clustering effects in $^{41,45,49}Ca^{*}$ nuclei formed in neutron induced reactions have been investigated within the quantum mechnaical fragmentation theory based dynamical cluster decay model (DCM) [1,2]. The results present that while moving towards neutron-rich $^{45}Ca^{*}$ and $^{49}Ca^{*}$ nuclei, the α preformation factor P_0 deceases considerably. The inculcation of relativistic mean field theory (RMFT) based microscopic T.B.E. [3,4] within DCM, give comparatively an enhanced α preformation factor for $^{41,45,49}Ca^{*}$ nuclei in comparison to the case of macroscopic T.B.E. based upon Davidson mass formula. Further, the cross-section associated with α-cluster emission shows a strong isospin dependence and decreases considerably with increasing n/p asymmetry of Ca^{*} nuclei. This trend is analogous to α preformation factor trend, demonstrating that P_0 contains the nuclear structure information. Furthermore, we inculcate the microscopic nuclear potential constructed via folding the RMFT cluster densities and M3Y nucleon-nucleon interaction within the DCM [5]. The neutron skin thickness of the Ar cluster, complementary to α-cluster, is varied and its effect upon the α preformation factor is explored. The results show that with an increase in the neutron skin of Ar cluster, the α preformation factor decreases.

References

[1] M. Kaur, B.B. Singh, R.K. Gupta, *Phys. Rev. C* **99** (2019) 014614.

[2] M. Kaur, B.B. Singh, R.K. Gupta, *Phys. Rev. C* **103** (2021) 054608.

[3] R.J. Furnstahl, B.D. Serot, H.B. Tang, *Nucl. Phys. A* **598** (1996) 539.

[4] M. Kaur, A. Quddus, A. Kumar, M. Bhuyan, S.K. Patra, *Nucl. Phys. A* **1000** (2020) 121871.

[5] A. M. Kobos, B.A. Brown, P.E. Hodgson, G.R. Satchler, *Nucl. Phys. A* **384** (1982) 65.