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Role of nucleon-nucleon and three-body interactions on the structure of ^{22}C halo system

In an effort to contribute towards a better understanding of the dynamics of three-body weakly-bound systems, we present a detailed analysis of the role of nucleon-nucleon (nn) and three-body interactions on the three-body ground-state structure, considering the $^{22}\text{C} \rightarrow ^{20}\text{C} + n + n$ system. It is found that even in the absence of the nn interaction, this system remains bound, provided a more attractive three-body interaction is considered. Similarly, for this system to remain bound in the absence of the three-body interaction, we found that a more attractive nn is required. Analyzing the ground-state binding energy as a function of the range ρ_0 of the three-body interaction, it is shown that when the nn interaction is included, the system is only bound for $\rho_0 \geq R_c$ (R_c being the matter radius of the core nucleus). When the nn interaction is removed, the system is only bound for $\rho_0 \geq 2R_c$. We then argue that the range ρ_0 could be another crucial parameter that may reveal how far the two halo neutrons are from the core nucleus.

In conclusion, we believe that these results provide a clear picture of the interplay of the nn and three-body interactions and their crucial role in a three-body weakly-bound system.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

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