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MINLOS-FADDEEV REGULARIZATION OF ZERO-RANGE INTERACTIONS IN THE THREE-BODY PROBLEM

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Application of zero-range two-body interactions in the three-body problem is not a trivial task, which manifests in appearance of Efimov or Thomas effects. One particular modification of zero-range interactions was suggested in the influential paper by Minlos and Faddeev [1] and was further analyzed in [2]. A main idea is to regularize the three-body problem by adding the effective three-body force, which reduces the interaction strength near the triple-collision point. As a result, the Efimov and Thomas effects are prohibited if the strength of regularizing term s exceeds the critical value σ_c. Recently, it was claimed that the condition $\sigma \geq \sigma_c$ provides the unambiguous description of the problem for three identical bosons [3] and for N identical bosons interacting with a distinct particle [4].

The proposed modification is studied and it is shown that to regularize the three-body problem, the parameter s should exceed another critical value $\sigma_r > \sigma_c$. More detailed analysis is given for the interval $\sigma_c \leq \sigma < \sigma_r$, for which unambiguous description requires one to set a boundary condition at the triple-collision point. These considerations are explicitly demonstrated for two-component system consisting of two identical bosons interacting with a distinct particle and for three identical bosons. To elucidate the description, the bound-state energies of three identical bosons are calculated as a function of s and an additional parameter b, which determines the boundary condition.

1. R.A. Minlos and L.D. Faddeev, Dokl. Akad. Nauk SSSR 141, 1335 (1961) [Sov. Phys. Doklady 141, 1335 (1962)].
2. S. Albeverio, et.al., Phys. Lett. A 83, 105 (1981).
3. Giulia Basti, et.al., arXiv:2107.07188 [math-ph] (2021).
4. D. Ferretti and A. Teta, arXiv:2202.12765 [math-ph] (2022).

The speaker is a student or young scientist

No

Section

1. Nuclear structure: theory and experiment

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