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Binding energies of light hypernuclei

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Light hypernuclei are a natural laboratory for studying YN and YY interactions [1]. The repulsive nature of the ΛN interaction leads to the fact that bound states in light nuclei are generated due to the $N-Y-N$ interaction. The decisive role in this interaction is played by the $\Lambda N \to \Sigma N$ conversion of one type of hyperons into another. Experimental data on hyperon separation energies $B_\Lambda[^4_\Lambda\mathrm{He}(0^+)]$-$B_\Lambda[^4_\Lambda\mathrm{H}(0^+)]$=+0.35 MeV from ground states of $^4_\Lambda$He, $^4_\Lambda$H hypernuclei also shows the charge dependence of YN interactions [2]. In this work, the binding energies of light hypernuclei are obtained by solving the homogeneous Faddeev and Faddeev-Yakubovsky intergral equations for 3 and 4 particles in phase space with model YN and realistic NN interactions. The main attention is paid to the comparison of the counting tactic based on the partial-wave expansion [3] of the matrix elements of the transition operators with given separable potentials, and counting tactic [4] that allows direct integration of the matrix elements in a few-body phase space with given local potentials. The procedure [4] for searching T-matrix for three-bodies of different masses without partial-wave expansion is generalized. Direct calculations have confirmed a good agreement between the two methods for calculations the hyperon separation energies in the lightest hypernuclei. The influence of higher partial waves of realistic separable potentials, its charge dependence, and the accuracy of the procedure for solving the Lippman-Schwinger equation by the Noyes-Kowalski method for given local potentials are also discussed.

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