Faddeev calculations for systems of non-identical particles

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Considered are structures of energy spectrum of light nuclei and hyprnuclei using a cluster model. The cluster approach is based on the configuration-space Faddeev equations [1] for a system of three non-identical particles. The analytical continuation method in a coupling constant is applied for calculation of the resonance parameters [2]. The results of calculations for low-lying spectra of the system α+p+n and α+Λ+n will be presented.

In particular the α+Λ+n cluster model describes hypothetical ${}^{6}_{\Lambda}$He hyprnucleus. The spin doublet (1^-,2^-) of ${}^{6}_{\Lambda}$He is interesting for the testing purpose of the theoretical hyperon-nucleon interaction models [3-5]. The 1^- ground state energy of ${}^{6}_{\Lambda}$He (singlet n-Λ spin state) has been evaluated in [3] (-0.17 MeV). Theoretical considerations for the 2^- state (triplet n-Λ spin state) have been done by Motoba et al. in [4] and Hiyama et al. in [5]. An indirect prediction for the state has been given in [6].

Within our model, the α-n interaction is constructed to reproduce the results of R-matrix analysis for α-n scattering data [7]. This potential simulates the Pauli Exclusion Principle for $\alpha - n$ in the s-state with a repulsive core. An α-Λ potential was proposed in [8]. For the $n - \Lambda$ interaction the s-wave potential [9] simulating model NSC97f was used. We calculated energies of the low-lying 1^-, 2^-, 2^+, 0^- states. Our predictions for the (1^-,2^-) energy gap agree with those obtained in other calculations. Structure of the ${}^{6}_{\Lambda}$He low-lying spectrum is presented in Fig. 1. Comparing the ^{6}He and ${}^{6}_{\Lambda}$He spectra one may consider the 0^- state as a "genuine hypernuclear" state.

This work is supported by NSF CREST (HRD-0833184) and NASA (NNX09AV07A).

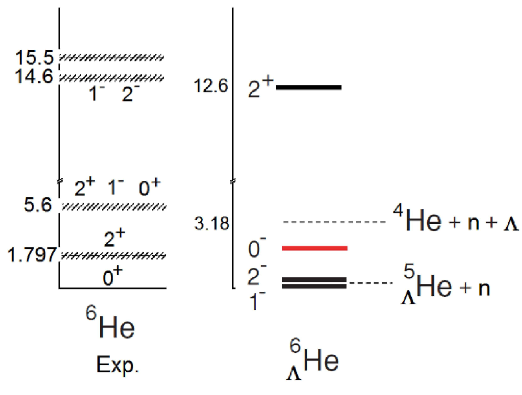

Figure 1: Spectra of the ^{6}He (experimental data are from [10]) and ${}^{6}_{\Lambda}$He

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