Role of the Pauli principle in cluster-cluster interaction

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This report is devoted to study of two-cluster potential energy for the light nuclei with a pronounced two-cluster structure within a microscopic method that takes into account the internal structure of the interacting clusters, correctly treats the Pauli principle and relays on a complete set of the oscillator functions to describe relative motion of clusters.

We analysed eigenvalues and eigenfunctions of the two-cluster potential energy matrix constructed with oscillator functions for the following nuclei: ^{6}Li= $\alpha + d$, ^{7}Li= α+^{3}H, ^{7}Be= α+^{3}He, ^{8}Be= $\alpha + \alpha$, ^{5}Li= $\alpha + p$, and ^{5}He= $\alpha + n$. In our calculations we used the Minnesota potential, the modified Hasegawa-Nagata potential and Volkov N2 potential as a nucleon-nucleon potential.

In general, the eigenvalues of the folding and exact cluster-cluster potential do not diverge considerably. However, the dependence of the exact cluster-cluster potential on the number of the invoked functions reveals a number of resonance states which are absent in the case of folding potential. The structure of the resonance states is much different from the eigenfunctions of the folding potential. Such resonance states are mainly localized in the region of small number of quanta in discrete space and, consequently, in the region of small distances between clusters in coordinate space.