PERTURBATION EXPANSION IN THE SYMMETRIZED BASIS AND THE EFFECTIVE INTERACTION IN THE CLUSTER MODEL

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The description of light nuclei by two-centre shell model wave functions has proved very successeful. However, there is no theory for the effective interaction in the model space. The basis composed of cluster-model wave functions is overcomplete (and non orthogonal). In this case the Rayleigt-Schroedinger perturbation expansion does not exist[1] neither an effective interaction based upon it.

This contribution contains two parts:

1. A modified Schroedinger perturbation expansion is presented. Instead of $H = H_0 - V$ the Hamiltonian $PH = H_0^S + V^S$ is used. The symmetry operator $P = P^\dagger = P^2$ has the property: $[H,P] = 0$, $[H_0,P] \neq 0$, $[V,P] \neq 0$, $[H_0^S,P] = 0$, $[V^S,P] = 0$. The perturbation series $E = E_0 + E_1 + \ldots$ and $\Psi = \Psi_0 + \Psi_1 + \ldots$ in order of V^S is expressed in the basis of products of simple functions which have no proper symmetry.

2. A derivation of the effective interaction for the cluster model is presented for the two-centre shall model in which the distance between clusters is assumed fixed. The interaction is expressed in terms of folded diagrams, each term being the sum Morita folded diagrams[2].

It is shown also that in some cases one can avoid the problems with the overcompleted basis by formulating the problem differently.

Different clusterings in the nucleus ^{7}Li are considered.

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1) L.Jansen, Phys.Rev. 162 (1967) 63.

2) T.Morita, Prog.Theor.Phys. 29 (1963) 351;
T.T.S.Kuo, S.Y.Lee and K.F.Ratcliff, Nucl.Phys.A176(1971)65.