Ground State Correlations Beyond RPA in Finite Fermi Systems

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Random Phase Approximation is the simplest theory of excited states of a quantum system including correlations in the ground state. In this theory one introduces a set of operators Q_ν: the vacuum of these operators defines the ground state of the system, while the action of $Q_\nu^\dagger$ on this vacuum gives the excited states. Having a Hartree-Fock (HF) basis as a reference, the $Q_\nu^\dagger$ operators are defined as linear superpositions of creation and annihilation particle-hole (*ph*) pair operators. The formal equations for the coefficients can be derived by using the equation of motion method. With a hamiltonian made of one- and two-body terms, the solution of these equations implies the evaluation of one- and two-body density matrices. In standard RPA, this difficulty is overcome by replacing the correlated ground state with the uncorrelated HF one. This introduces a clear inconsistency, especially when the two differ appreciably from each other.

In the first part, previous attempts to eliminate as far as possible the above inconstintency are shortly reviewed and some results are presented. In the second part, a new approach is proposed to go further towards a self-consistent RPA. Finally, some results on metallic clusters are presented. The latters have been obtained by using a simplified version of the approach which requires less computational effort. It represents, however, a significant improvement over the methods used so far.

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Particle Decay of High-lying States in Odd Nuclei

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A method for calculating non-statistical particle decay of excited states in odd nuclei is presented. Using the quasiparticle-phonon model partial cross sections and branching ratios for the neutron decay of the high angular momentum states in ^{209}Pb and ^{91}Zr excited by means of the (α,^{3}He) reaction have been evaluated. The calculated branching ratios are compared with existing experimental data.

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