A simple tool to study many-body forces

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The envelope theory [1, 2], also known as the auxiliary field method, is a technique to compute approximate solutions of a quantum system with N identical particles. It has been generalized for various systems with arbitrary kinematics and one- or two-body potentials [3, 4]. The basic idea is to replace the Hamiltonian H under study by an auxiliary Hamiltonian $\tilde{H}$ which is solvable, the eigenvalues of $\tilde{H}$ being optimized to be as close as possible to those of H. The method is easy to implement since it reduces to find the solution of a transcendental equation. Recently, its accuracy has been tested for eigenvalues and eigenvectors by computing the ground state of various systems containing up to 10 bosons [5, 6]. We show here that the envelope theory can be extended to compute the eigensolutions of a system of identical particles with a type of many-body forces often used in phenomenological models.

References

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