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Next-Order Analytic Wave Function for Correlated Confined Quantum Systems; Application to BEC[1] W. BLAKE LAING, MARTIN DUNN, DERRICK R. TOTH, DEBORAH K. WATSON, University of Oklahoma — We have constructed the next-order correlated N-body wave function for an isotropic confined quantum system using a dimensional perturbation theory (DPT) approach. This additional perturbative order represents a significant advancement in our large-scale project of analytically describing beyond-mean-field effects in N-body systems using DPT. To solve this problem, we assemble a number of analytic building blocks within the DPT framework (such as "symmetry coordinates", coupling products of irreducible representations, and a novel graph-theoretical technique). This method is well-suited for systems with "tunable" interactions because it makes no assumptions concerning the number of particles or the strength of inter-particle interactions. As an application, we report observable results for the density profile, excitation frequencies, and ground state energy of a fully correlated BEC in a harmonic trap.

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