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Analytic Beyond-Mean-Field BEC Wave Functions[1] MARTIN DUNN, W. BLAKE LAING, DEBORAH K. WATSON, University of Oklahoma, JOHN G. LOESER, Oregon State University — We present analytic N-body beyond-mean-field wave functions for Bose-Einstein condensates. This extends our previous beyond-mean-field energy calculations to the substantially more difficult problem of determining correlated N-body wave functions for a confined system. The tools used to achieve this have been carefully chosen to maximize the use of symmetry and minimize the dependence on numerical computation. We handle the huge number of interactions when N is large ($\sim N^2/2$ two-body interactions) by bringing together three theoretical methods. These are dimensional perturbation theory, the FG method of Wilson et al, and the group theory of the symmetric group. The wave function is then used to derive the density profile of a condensate in a cylindrical trap.This method makes no assumptions regarding the form or strength of the interactions and is applicable to both small-N and large-N systems.

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