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Construction Schemes for Fully Anti-Symmetric Four-Body Wave Functions in (3+1) and (2+2) Configurations

Lia Leon [1]

[1] Marymount Manhattan College, New York, NY 10021, USA

Abstract

One of the important problems that arise when investigating dynamics of Few-Body Nuclear systems within the framework of the Hyperspherical Function (HF) Method, is the problem of constructing wave functions that are anti-symmetric under particle interchange. Parentage scheme of symmetrization (PSS) allows to construct N-body symmetrized HF from functions with arbitrary quantum numbers by the use of the transformation coefficients related with the permutations of last two particles. N-body HF corresponding to the representation of the N-particle permutation group were obtained for N=3,4,5,6 by finding parentage coefficients and constructing linear combinations of the N-particle functions corresponding to the irreducible representations of N-1 particle permutation group . However, construction schemes for the fully anti-symmetric wave functions, consisting of spin and isospin parts along with the hyperspherical parts, has not been systematically addressed in the literature. Solution of this problem becomes sufficiently complex as number of particles increases. This article develops construction schemes for four particle wave functions that are anti-symmetric under particle interchange by building all possible combinations of spin, isospin, and hyperspherical parts. It is demonstrated that there are sixteen possible ways to construct fully anti-symmetric four-body wave functions when spin and isospin parts are represented by [4], [31], and [22] representations of four-particle permutation group . A complete set of fully anti-symmetric four-body wave functions is obtained for both (3+1) an (2+2) configurations. Proposed construction schemes can easily be generalized for the systems with any number of particles.

Biography:

Dr. Lia Margolin has a Ph.D. in Theoretical Nuclear Physics and Computational Mathematics from Tbilisi State University, Georgia. She has published more than 25 papers in international peer-reviewer journals and has been awarded International Science Foundation (ISF) grant for her research accomplishments in Theoretical Nuclear Physics. She is an Associate Professor of Mathematics and Mathematics Department Chair at Marymount Manhattan College in New York City, NY. She serves at the Internaional Research Conference Scientific and Technical Committee as a member of Editorial Review Board on Nuclear and Quantum Engineering.

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