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Alpha correlation in term of the hyper-Pfaffian

A new theoretical approach for alpha correlation in nuclei is investigated in term of the hyper-Pfaffian [1]. The Pfaffian has been recently investigated to formulate the pairing correlation and is useful in investigating the sign-problem of Onishi formula [2], Wick's theorem, and the variational Monte Carlo [3]. While the hyper-Pfaffian, which is an extension of the Pfaffian for multi-dimensional tensor, is unfamiliar in physics.

In this contribution, we show that the overlap matrix element between M-scheme state and quartet wave function, which plays a key role in the variational Monte Carlo method, can be represented by the hyper-Pfaffian with $k = 4$. The hyper-Pfaffian, however, seems not to have many useful mathematical properties and is difficult for numerical computation. To overcome this difficulty, we found that the hyper-Pfaffian with $k = 4$ for the alpha-like quartet wave function can be calculated as the sum of usual Pfaffians, by which its numerical evaluation becomes faster and feasible. The first result will be shown in [4]. (See also [4], for relevant references concerning the Pfaffian and its applications, and definitions of the hyper-Pfaffian in mathematics.) We present its formula and show the alpha correlation in the nuclear shell model.

References

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