Comparison of Various HFB Overlap Formulae

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Abstract

The nuclear many-body approach beyond the mean-field approximation demands overlap calculations of different many-body states. In the modern interest of research, such overlaps are required in the generator coordinate method [1] that employs, for instance, the Hartree-Fock-Bogoliubov (HFB) states. Before the Onishi formula [2] was found, the overlaps of different HFB states were only evaluated approximately. It was expected that the finding of the formula could solve all the difficulties relevant to the evaluation of the overlaps, but the numerical implementation of the Onishi formula was more difficult than expected. After long-time struggles, Hara, Hayashi and Ring were the first to succeed in applying the Onishi formula to numerical calculations in the context of the angular momentum projection [3]. However, their method (HHR) had to obey the computational limitation at that time, so that high-precision calculations were not easy to be performed, particularly in the backbending regions. To improve the HHR method, Neergård and Wüst proposed an alternative approach [4].

As the computer technology advanced, the above-mentioned difficulty in the HHR method was greatly eased. The HHR method based on the continuity of the overlap in the Euler space was preferred for some reasons, and the method by Neergård and Wüst (NW), which is based on the diagonalization, was almost forgotten except an application to the VAMPIRE project [5]. However, the HHR method was found to face another difficulty at high spin [6].

Recently, Robledo proposed a different approach to the HFB overlap calculation [7] by means of the Pfaffian, which demonstrates a great success. In my talk, a comparison is made for different formulae of HHR, NW and Robledo through numerical calculations.

References