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A chiral three-body force for realistic nuclear shell model calculations

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In the recent years, the use of the forces derived from the EFT has grown exponentially. The chiral two-nucleon forces have been used in many microscopic calculations of nuclear reactions and structure. In some cases they have been complemented by the chiral three-nucleon forces very succesfully applications to few-nucleon reactions, structure of light-and medium-mass nuclei, and nuclear and neutron matter. However, its inclusion in heavier systems is very challenging due to the rapid increase in the number of involved matrix elements along with the growing number of nucleons. Therefore, HPC codes and resources are badly needed. We have implemented the chiral 3N force up to N2LO [1] in realistic shell model calculations. This 3N potential at N2LO consists of three components, the two-pion term, the one-pion term and the contact term. This 3N force, together with the chiral 2N component, is used for deriving effective Hamiltonians for Shell Model calculations by resorting to the Kuo-Lee-Ratcliff folded-diagram expansion [2]. This approach is based on a perturbative expansion of the vertex function called Qbox (for details see ref. [3]).
Shell-model calculations using this effective Hamiltonian were performed for nuclei belonging to the p shell [1], with the aim of making a benchmark with the ab initio no-core shell model results. Having obtained satisfactory results, we moved to heavier systems, up to fp shell nuclei [4], to reproduce the experimental shell evolution towards and beyond the closure at N = 28. We plan to go beyond this mass region, and, in order to do that, we need to improve the performances of our three body code whose HPC properties will be also discussed.

1. T. Fukui, L. De Angelis, Y. Z. Ma, L. Coraggio, A. Gargano, N. Itaco, and F. R. Xu Phys. Rev. C 98, 044305 (2018).
2. T. T. S. Kuo and E. Osnes, Lecture Notes in Physics (Springer- Verlag, Berlin, 1990), Vol. 364.
3. K. Suzuki and S. Y. Lee, Prog. Theor. Phys. 64, 2091 (1980).
4. Y. Z. Ma, L. Coraggio, L. De Angelis, T. Fukui, A. Gargano, N. Itaco, and F. R. Xu, Phys. Rev. C, 100, 034324 (2019).

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