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Chiral two- and three-nucleon interactions in ring diagram calculation for binding energy of 4He

In addition to a chiral N 3LO two-nucleon potential V2N , we include an in-medium three-nucleon (NNN) force V3N as the input elementary interaction in the ring diagram calculation for the binding energy of 4He. The low momentum Vlowk effective interaction matrix elements of V2N and V3N are calculated for the uses in this study. Parameters cD and cE in V3N are taken from the cD – cE curve in fitting A=3 nuclei, and the density arising from the contact term in V3N is set to be that
at the nucleus'average radius. The calculated binding energy, as expected, is too weak when only V2N is considered. As V¯3N is included, the experimental binding energy is accurately reproduced. The first and the second order ring diagrams make about 90% contribution of the binding energy. All other higher order diagrams bring the result much closer to the experimental measurement. The same procedure with the same magnitudes of CD , cE being applied to several other nuclei also leads very accurate binding energies

Primary author: Prof. TZENG, YIHARN (Institute of Physics, Academia Sinica, Taipei)

Co-authors: Prof. TZENG TSAY, Shwu-Yun (Dept. of Electro-Optical Engineering, National Taipei University of Technology, Taipei 10608, Taiwan, ROC); Prof. KUO, T. T. S. (Department of Physics, State University New York at Stony Brook Stony Brook, New York 11794, USA)

Presenter: Prof. TZENG, YIHARN (Institute of Physics, Academia Sinica, Taipei)

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