A Python package for the commutator of many-body operators

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Abstract

In recent years, the In-Medium Similarity Renormalization Group (IMSRG) has been making great progress in ab initio nuclear many-body theory. At present, the many-body operator is generally truncated to two-body in the IMSRG. In order to extend the many- body truncation to the normal-ordered three-body level, it's necessary to develop the IMSRG(3), which involves a great number of complex calculation processes of many-body operators. Therefore, writing a computer program to achieve auto-calculation would help researchers reduce the cost of time and energy on such processes.

To achieve the program, it is necessary to translate the theoretical calculation process into a series of algorithms and apply these algorithms to the calculation of symbols.Under the Python platform, based on the computer algebra system provided by SymPy, this Python package, called combo, can create objects of related classes to indicate the indi- cators and operators. By applying these objects to a series of algorithms, the combo can calculate the commutator of two arbitrary many-body operators. Moreover, after solv- ing the problem above, an interface function matching the Angular Momentum Coupling Program (AMC) is written and can give the result that coupled the angular momentum.

Specifically, four modules in this package can: a) calculate the product and com- mutator of two arbitrary many-body operators, b) apply symbols' rule c) regulate the expressions and provide some auxiliary functions. d) process the expressions for output.

Based on the functions above, the combo package not only can reproduce the rele- vant calculational process in the IMSRG but also lays the foundation for the development of IMSRG(3).This paper introduces the function of each module of this package and il- lustrates the algorithm's workflow in some logic diagrams.

Keywords: Python, IMSRG, commutator of normal-ordered operators, combo

1. Introduction

References

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