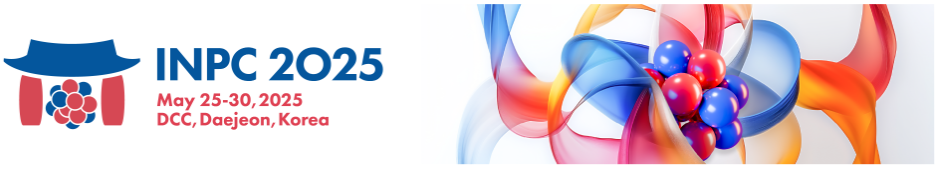

Contribution ID: **264** Type: **Contributed Poster Presentation**

Cooper quartet correlation in infinite symmetric nuclear matter

Study of quantum many-body phenomena is one of most exciting issues in modern physics. Since the involvement of various degrees of freedom, the nuclear matter is a promising candidate for the investigation. Meanwhile, the superconductivity as a result of the condensation of Cooper pairs that are formed by two electrons, can be successfully described by the Bardeen-Cooper-Schrieffer (BCS) theory. In the nuclear system, one can have not only different types of pairs formed by two nucleons, but the existence of the four-body structure called alpha-like Cooper quartets is also a long-standing issue. It will be interesting to develop microscopic models for the systematic description of both pair and quartet condensations in nuclear systems.

To this end, in this study we investigate both the pair and quartet correlations in four-component fermionic systems at the thermodynamic limit within a variational many-body theory. In detail, the BCS-type trial wave function in the momentum space is extended to the infinite symmetric nuclear matter, where the pair and quartet correlations are described by the coherent superposition of neutron-proton Cooper pairs and alpha-like Cooper quartets. By solving the variational equations obtained from the quartet BCS framework, we present the numerical results of the quasiparticle dispersion and the variational parameters describing the momentum distribution of nucleons under the presence of deuteron and quartet correlations.

The present results may contribute to the interdisciplinary understanding of fermionic condensations beyond the BCS paradigm in many-body systems. As future works, the improvement of trial wave function and connection to realistic experiments will also be interesting to investigate.

[1] YG, Tajima, and Liang, Phys. Rev. C 105, 024317 (2022)
[2] YG, Tajima, and Liang, Phys. Rev. Res. 4, 023152 (2022)

Primary author: GUO, Yixin (Center for Exotic Nuclei Studies, Institute for Basic Science)

Co-authors: Prof. LIANG, Haozhao (The University of Tokyo); Dr TAJIMA, Hiroyuki (The University of Tokyo)

Presenter: GUO, Yixin (Center for Exotic Nuclei Studies, Institute for Basic Science)

Session Classification: Poster Session

Track Classification: Nuclear Structure