Contribution ID: **79** Type: **Invited talk**

Quartet superfluid in mass-imbalanced ultracold Fermi mixtures

Wednesday 4 September 2024 14:40 (40 minutes)

In this talk, I will introduce our recent works on universal few-body clusters and the resulted high-order fermion superfluid in mass-imbalanced Fermi mixtures. First, we exactly solve the (N+1) problems in 2D with N=3 and 4, where a light atom interacts with N heavy fermions via contact potentials. It is found that the critical heavy-light mass ratios to support a (3+1) tetramer and a (4+1) pentamer are sufficient low to be accessible by a number of mass-imbalanced Fermi mixtures now available in cold atoms laboratories. Further, we study the associated few-body correlations in modifying the Fermi polaron properties and fermion superfluidity of a many-body heavy-light system. In particular, we identify a new fermion superfluidity, called the quartet superfluid (QSF), well beyond the conventional pairing framework in such simple two-component Fermi system. This superfluid phase corresponds to the condensation of quartet (or tetramer) clusters and thus features high-order correlations, as manifested in the momentum-space crystallization of pairing field and the density distribution of heavy fermions. Finally, we explore the dimensional crossover of various universal clusters from 3D to 2D, and show that these clusters are very robust against the presence of an axial confinement and a finite effective range. This suggests the detectability of few-body clusters and quartet superfluid in realistic quasi-2D ultracold Fermi mixtures.

Career stage

Relevant publications (optional)

Short bio (50 words) or link to website

References

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