Dynamical mean-field analysis of multi-orbital spin-triplet superconductivity

Tatsuya Miki[1] and Yusuke Nomura[1,2]
[1] *Institute for Materials Research (IMR), Tohoku University, Sendai 980-8577, Japan*
[2] *Advanced Institute for Materials Research (WPI-AIMR), Tohoku University, Sendai 980-8577, Japan*

Keywords: Superconductivity, Multi-orbital systems, Dynamical mean-field theory

In conventional superconductors, Cooper pairs typically form spin-singlet states. In contrast, spin-triplet superconductivity in strongly correlated electron systems has long attracted considerable attention because the spin degrees of freedom of Cooper pairs lead to unique superconducting states and novel superconducting phenomena. Therefore, it is important not only to understand the microscopic mechanisms underlying spin-triplet superconductivity but also to investigate the physical properties of the superconducting state.

In multiorbital electron systems, orbital degrees of freedom coexist with spin degrees of freedom, and their interplay with electronic correlations gives rise to a variety of electronic states. In particular, Hund coupling promotes the formation of local magnetic moments and induces characteristic correlation effects, including the spin-freezing crossover [1]. Moreover, previous studies using dynamical mean-field theory (DMFT) have shown that fluctuations of local magnetic moments in the spin-freezing crossover regime enhance interorbital *s*-wave spin-triplet superconductivity [2]. Furthermore, systematic investigations of susceptibilities toward various ordered states in the two-orbital Hubbard model have revealed phase diagrams containing superconducting and magnetically ordered phases that depend on Hund coupling [3]. These studies have provided important insights into spin-triplet superconductivity involving orbital degrees of freedom, motivating further investigations into the physical properties of the superconducting state.

In this study, we investigate the physical properties of the spin-triplet superconducting state in the two-orbital Hubbard model using DMFT, with particular emphasis on calculations performed within the superconducting phase. Specifically, we perform an energy-resolved decomposition of the pairing energy to clarify how Hund coupling contributes to Cooper-pair formation and to identify the characteristic energy scales associated with the pairing mechanism. Based on this analysis, we discuss the microscopic role of Hund coupling in superconducting pairing. Furthermore, we employ a method based on Cooper pairs with finite center-of-mass momentum to evaluate the superconducting coherence length and magnetic penetration depth [4], and investigate the behavior of superconducting stiffness in the multiorbital spin-triplet superconducting state. In this presentation, we discuss how Hund coupling affects both the pairing energy and the motion of Cooper pairs within the superconducting state.

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