第52回トポロジカル物質科学セミナー
Topological Materials Science Seminar (52)

Two Topics on Topological Superconductivity

(1) Superconductivity in time-reversal-symmetry-broken two-dim. system: application to FeSe

Mark Fischer

(2) The Concept of Superconducting Fitness

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Place: Room 525, Science Bldg. #5 (Physics), Kyoto University
Date: Sep. 14 (Thu), 2017
Time: 10:30 -12:00

Abstract:

(1) Monolayer FeSe on $SrTiO_3$, which exhibits high-temperature superconductivity, has recently been proposed to additionally possess antiferromagnetic order. This magnetic order, however, breaks both inversion and time-reversal symmetry, the two symmetries guaranteeing a weak-coupling superconducting transition in three dimensions. Motivated by this finding, I will reexamine the minimal symmetries protecting superconductivity in two dimensions and the resulting order parameters. I will show that having a combination of either symmetry with a mirror operation on the basal plane is sufficient in two dimensions and discuss a minimal model with only one of the symmetries present. Finally, I will apply these considerations to the case of FeSe. Interestingly, despite having both combined symmetries, only one superconducting state is fully stable in antiferromagnetic FeSe, namely a chiral spin-triplet order, while any phonon-mediated s-wave order is strongly suppressed by the local ordered moments.

(2) In this talk I propose a general scheme to probe the compatibility of arbitrary pairing states with a given normal state Hamiltonian by the introduction of a concept called "Superconducting Fitness". This quantity gives a direct measure of the suppression of the superconducting critical temperature in the presence of key symmetry-breaking fields and can be used as a tool to identify nontrivial mechanisms to suppress superconductivity even in complex multi-orbital systems. This concept can also be used in order to engineer normal state Hamiltonians in order to favour or suppress different order parameters. I discuss the application of this idea to Sr_2Ru0_4, $CePt_3Si$ and KFe_2As_2.

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