Theoretical Study of Fulde-Ferrell-Larkin-Ovchinnikov Superconductors

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Recently compelling experimental evidence for the existence of the long-sought Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) State has been found in the heavy-fermion superconductor CeCoIn$_5$. In this talk I will report results of theoretical studies FFLO State in unconventional superconductors. In particular, I will discuss (i) the possibility of using various phase-sensitive measurements to detect the FFLO state and measure the momentum of the superconducting order parameter, including the Josephson effect,\(^1\) the exotic vortex lattice structure,\(^2\) and the spectrum of surface Andreev bound states of the FFLO state; (ii) An exact solution that indicates the second order nature of the BCS-FFLO transition in the quasi-1D limit, and the critical behavior of the transition;\(^3\) (iii) An analysis of fluctuation effects based on renormalization group, which suggests that the transition between the normal and FLLO states is a fluctuation-driven first order transition, even when mean-field theory suggests a second-order transition.\(^4\) Comparisons will be made with experiments whenever appropriate.


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