Fulde-Ferrel-Larkin-Ovchinnikov superconducting phase for paired quasiparticles with spin-dependent masses and their distinguishability

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9.7 cm

Spin dependence of quasiparticle mass has been observed recently in $CeCoIn_5$ and other systems. It emerges from strong electronic correlations in a magnetically polarized state and was predicted earlier. Additionally, the Fulde- Ferrell-Larkin-Ovchinnikov (FFLO) phase has also been discovered in $CeCoIn_5$ and therefore, the question arises as to what extent these two basic phenomena are interconnected, as it appears in theory. Here we show that the appearance of the spin-split masses essentially extends the regime of temperature and applied magnetic field, in which FFLO state is stable, and thus, it is claimed to be very important for the phase detectability. Furthermore, in the situation when the value of the spin quantum number $\sigma = \pm 1$ differentiates masses of the particles, the fundamental question is to what extent the two mutually bound particles are indistinguishable quantum mechanically? By considering first the Cooper-pair state we show explicitly that the antisymmetry of the spin-pair wave function in the ground state may be broken when the magnetic field is applied.

13.4 cm

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