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Conductance spectroscopy of a strongly correlated superconductor

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We study theoretically the conductance of a junction between a normal metal and a strongly-correlated superconductor in applied magnetic field in the Pauli limit [1]. Depending on the field strength the superconductor is either in the Bardeen-Cooper-Schrieffer (BCS), or in the Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) state of the Fulde-Ferrell (FF) type. The strong correlations are accounted for by means of the Gutzwiller approach, what leads naturally to the emergence of spin-dependent masses (SDM) of quasiparticles when the system is spin-polarized. The case without strong correlations (with spin-independent masses, SIM) is analyzed for comparison. We study both s-wave and d-wave symmetry of the superconducting gap and concentrate on the parallel orientation of the Cooper pair momentum Q with respect to the junction interface. The junction conductance is presented for a series of barrier strengths (i.e. in the contact, intermediate, and tunneling limits). The situation with strong correlations differs essentially from that in the uncorrelated case. Our analysis provides thus an experimentally accessible test for the presence of strong correlations in the superconducting state.

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[1] J. Kaczmarczyk and J. Spałek, Phys. Rev. B, in press, arXiv:1106.1574.