SUPERCURRENT INDUCED NONEQUILIBRIUM EFFECTS IN MESOSCOPIC SUPERCONDUCTORS WITH ZEEMAN SPLITTING

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Thermoelectric effects in ferromagnetic-superconducting hybrid structures have attracted a lot of interest in the last few years, due to the interesting physics revealed by the interplay between superconductivity and magnetism. Huge thermoelectric effects were theoretically predicted[1] and experimentally observed[2] in such structures. Recently, a long-range spin accumulation in a ferromagnetic-superconducting hybrid structure with a strong Zeeman splitting was observed[3]. This unusual phenomena has been explained via the thermoelectric effect for Bogolubov quasiparticles in a spin-polarized superconductor[4]. However, the effect of the supercurrent was not discussed in these studies. Since the supercurrent induces a charge imbalance in the presence of a temperature gradient[5, 6], including the supercurrent in this structure causes some interesting thermoelectric effects, such as the spin Seebeck effect. We use the theoretical framework developed in Ref.[4] based on the quasiclassical Usadel-Keldysh formalism, include the supercurrent and spin supercurrent in the superconducting wire, and investigate the nonequilibrium effects in a mesoscopic superconductor with Zeeman splitting.

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