Electron transport in interacting hybrid mesoscopic systems

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Abstract

A unified theory for the current through a mesoscopic region of interacting electrons connected to two leads which can be either ferromagnet or superconductor is presented, yielding Meir-Wingreen-type formulas when applied to specific circumstances. In such a formulation, the requirement of gauge invariance is satisfied automatically. Moreover, one can judge unambiguously what quantities can be measured in the transport experiment.