Critical conductance of a one-dimensional doped Mott insulator

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We consider theoretically the two-termal conductance of a one-dimensional Mott insulator close to the commensurate-incommensurate quantum phase transition to a conducting state. We treat the leads as Luttinger liquids. At a specific value of compressibility in the leads, corresponding to the Luther-Emery point, the conductance can be computed in terms of a scattering problem of non-interacting fermions with charge $e/\sqrt{2}$. The Mott insulator can be approximated as an effective point scatterer with a transmission probability that strongly depends on energy in a threshold-like fashion. At the Luther-Emery point, the temperature dependence of the conductance across the quantum phase transition is then described by a Fermi function. The deviation from the Luther-Emery point in the leads results in an interaction among fermionic scattering states and changes the temperature dependence qualitatively. In the metallic state, the low-temperature conductance is determined by the properties of the leads, and is described by the conventional Luttinger liquid theory. In the insulating state, conductance still occurs via activation of $e/\sqrt{2}$ charges, and is independent of the Luttinger liquid compressibility.