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Electronic transport in inhomogeneous quantum wires[1] JEROME RECH, K. A. MATVEEV, Argonne National Laboratory — We study the transport properties of a long non-uniform quantum wire where the electron-electron interactions and the density vary smoothly at large length scales. We show that these inhomogeneities lead to a finite resistivity of the wire, due to a weak violation of momentum conservation in the collisions between electrons. Estimating the rate of change of momentum associated with non-momentum-conserving scattering processes, we derive the expression for the resistivity of the wire in the regime of weakly interacting electrons and find a contribution linear in temperature for a broad range of temperatures below the Fermi energy. By estimating the energy dissipated throughout the wire by low-energy excitations, we then develop a different method for deriving the resistivity of the wire, which can be combined with the bosonization formalism. This allows us to compare our results with previous works relying on an extension of the Tomonaga-Luttinger model to inhomogeneous systems.

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