Fractional conductances, dc noise, and fractional charges in the strongly interacting one-dimensional systems

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This research considers a strongly interacting one-dimensional system with N channels and explains the variety of experimentally observed fractional conductances in GaAs/AlGaAs heterostructures [1-3]. We study relevant backscattering perturbations that create gaps in the corresponding fields, thereby altering the system's properties. We model these gapped fields by introducing masses for the bosonic fields and sending them to infinity to compute the correlator of the two fields that describe the original channels. The exact solution of the corresponding Green function in the low-frequency limit enables us to apply the Kubo formula to calculate the system's dc conductance [4], which accounts for all the seminal experimental results [1-3]. We construct a pseudo-orthogonal transformation that reduces each backscattering term to a single-channel field [5] and derive the expression for the fractional charge transferred during the tunneling of the gapped mode, which dominates the dc shot noise. The coexistence of two gapped modes (two relevant perturbations) affects the tunneling of fractional charges in each of the modes.

References:

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