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Conductivity with cold atoms in optical lattices

Abstract: We discuss conductivity with cold neutral atoms in an optical lattice. From two main formulations of the problem — dissipative or ballistic transport -- we focus on the second one, where one studies atomic current between two reservoirs of cold atoms connected by a transport channel [1]. We analyze the problem from the first principles by considering microscopic models of reservoirs. This allows us to reveal decoherence effects of the reservoirs on the carriers in the channel and calculate the stationary single-particle density matrix of the carries, that suffices to predict the current magnitude [2].

[1] J. Brantut, J. Meineke, D. Stadler, S. Krinner, and T. Esslinger, Conduction of ultracold fermions through a mesoscopic channel, *Science* 337, 1069 (2012).

[2] A.R.Kolovsky, Z.Denis, and S.Wimberger, Landauer-Buettiker equation for bosonic carriers, *Phys. Rev. A* 98, 043623 (2018).