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Current conserving theory at the operator level JIANGTAO YUAN, YIN WANG, JIAN WANG, The university of Hongkong — The basic assumption of quantum transport in mesoscopic systems is that the total charge inside the scattering region is zero. This means that the potential deep inside reservoirs is effectively screened and therefore the electric field at interface of scattering region is zero. Thus the current conservation condition can be satisfied automatically which is an important condition in mesoscopic transport. So far the current conserving ac theory is well developed by considering the displacement current which is due to Coulomb interaction if we just focus on the average current. However, the frequency dependent shot noise does not satisfy the conservation condition since we do not consider the current conservation at the operator level. In this work, we formulate a generalized current conserving theory at the operator level using non-equilibrium Green's function theory which could be applied to both average current and frequency dependent shot noise. A displacement operator is derived for the first time so that the frequency dependent correlation of displacement currents could be investigated. Moreover, the equilibrium shot noise is investigated and a generalized fluctuation-dissipation relationship is presented.

Jiangtao Yuan
The university of Hongkong

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