# Charge transfer in the presence of equilibrium and non-equilibrium environments

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Charge transfer in mesoscopic systems is strongly influenced by energy exchange with the environment. This can lead to violations of macroscopically valid transport relations, e.g., change the Wiedemann-Franz ratio between heat- and electrical conductance [1].

Of particular interest are systems, where the environment is driven from equilibrium by strong coupling to the charge transport process. These ideas are illustrated in a recently realized experimental setup [2], where Cooper pair transport across a voltage biased Josephson junction is coupled to a microwave resonator. This system can offer new insights in environmental effects on transport in and out of equilibrium, as it allows observing correlations in charge and photonic transport simultaneously [3].

The presented system is one example of a class of various recent systems combining different mesoscopic charge transport processes with QED circuits, which offer rich possibilities, e.g., non-classical light creation and entanglement of charge and/or photon flow.

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