Mathematical Physics

# Non-equilibrium Steady States of Quantum Systems on Star Graphs

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Non-equilibrium steady states of quantum fields on star graphs are explicitly constructed. These states are parametrized by the temperature and the chemical potential, associated with each edge of the graph. Time reversal invariance is spontaneously broken. We study in this general framework the transport properties of the Schroedinger and the Dirac systems on a star graph, modeling a quantum wire junction. The interaction, which drives the system away from equilibrium, is localized in the vertex of the graph. All point-like vertex interactions, giving rise to self-adjoint Hamiltonians possibly involving the minimal coupling to a static electromagnetic field in the ambient space, are considered. In this context we compute the exact electric steady current and the non-equilibrium charge density. We investigate also the heat transport and derive the Casimir energy density away from equilibrium. The appearance of Friedel type oscillations of the charge and energy densities along the edges of the graph is established. We focus finally on the noise power and discuss the non-trivial impact of the point-like interactions on the noise.

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