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电荷离散化时电感耦合介观电路中的量子效应

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摘要 针对电感耦合介观电路模型，计及电荷的离散性，提出一种在电荷算符本征态构成的新Fock空间中计算系统量子效应的方法．该方法通过引入最小平移算符，将体系量子Hamilton量、物理电流等表示为电荷算符和阶梯算符的函数，直接利用阶梯算符的性质计算介观电路中电荷、电流以及能量的量子涨落；所得结果与电感参量等密切相关．指出在设计量子线路、纳米电子器件时为降低量子噪声而需要考虑的因素．

关键词 介观电路 电感耦合 电荷离散 量子涨落

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The quantum effect in the inductance-coupling mesoscopic circuit with the charge discreteness

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Abstract

In the inductance-coupling mesoscopic circuit, by taking account of the charge discreteness, a method for calculating quantum effects is proposed in the new Fock space that is formed by the eigenstate of charge operator. In this method, by introducting the minimum shift operator, the system Hamilton and the physics current are expressed according to the charge operator and the ladder operator, and the quantum fluctuations of the charge, current and energy are calculated directly by the character of the ladder operator. The obtained results are related with self-inductance closely. In designing the quantum circuit and the nanoelectroic devices, the considerable factors are given for the quantum noise reduction.

Key words mesoscopic circuit inductance-coupling charge discreteness quantum fluctuation

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