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Effects of magnetic impurities on electron transmission in a quantum nanoring

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Abstract

In this paper we study the Aharonov-Bohm oscillations of transmission coefficient for an electron passing through a quantum nanoring with two identical magnetic impurities using quantum waveguide theory. It is shown that the Aharonov-Bohm oscillations are independent of the coupling constant between the electron and magnetic impurities for the singlet spin state of impurities, while for the other spin states of impurities the Aharonov-Bohm oscillations decrease rapidly with an increasing coupling constant. For a triplet spin state of impurities, we can use this system as a quantum NOT gate with an efficiency upper than 50% by adjusting the coupling constant between the electron and magnetic impurities and the magnetic flux passing through the ring.

Keywords: quantum ring, magnetic impurity, Aharonov-Bohm oscillations, spin entanglement, spin NOT gate

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