Flux qubits on nanorings

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Model calculations on mesoscopic quasi 1D ring with a barrier have been performed which show that quantum tunneling between states with nearly equal energies and opposite persistent currents can lead to a formation of a qubit. The ring can be made of a semiconductor or a carbon nanotube and it is shown that it can be effectively reduced to a two level system. Level repulsion of the ground state and the excited state is found indicating symmetric and antisymmetric superposition of persistent current states with opposite polarity. Two or more qubits can be coupled by means of the flux that the circulating currents generate. We expect that the magnetic degrees of freedom in quantum rings have longer decoherence times than charge degrees of freedom.

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