2002 Vol.38 No.3 pp.285-291 DOI:

Nonadiabatic Geometric Quantum Computation with Asymmetric Superconducting Quantum Interference Device

HAO San-Ru,[1,2] HOU Bo-Yu,[1] XI Xiao-Qiang,[1] and YUE Rui-Hong[1]

[1] Institute of Modern Physics, Northwest University, Xi'an 710069, China
[2] Calculating Physics Division, Department of Computer Teaching, Hunan Normal University, Changsha 410081, China
(Received: 2001-11-22; Revised: 2002-3-7)

Abstract: We propose a method of controlling the dc-SQUID (superconducting quantum interference device) system by changing the gate voltages, which controls the amplitude of the fictitious magnetic fields B_z, and the externally applied current that produces the piercing magnetic flux Φ_x for the dc-SQUID system. We have also introduced a physical model for the dc-SQUID system. Using this physical model, one can obtain the non-adiabatic geometric phase gate for the single qubit and the non-adiabatic conditional geometric phase gate (controlled NOT gate) for the two qubits. It is shown that when the gate voltage and the externally applied current of the dc-SQUID system satisfies an appropriate constraint condition, the charge state evolution can be controlled exactly on a dynamic phase free path. The non-adiabatic evolution of the charge states is given as well.

PACS: 03.65.Bz, 03.67.-a
Key words: non-adiabatic geometric phase gate, dc-SQUID , quantum computation

[Full text: PDF]

Close