Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Entanglement of Two Josephson Vortex Quantum Bits in Resonant Cavity ISAAC O'BRYANT, RAMESH P. DHUNGANA, JU H. KIM, University of North Dakota — We investigate the entanglement between two Josephson vortex qubits (JVQ's) in a resonant cavity. A JVQ may be fabricated using two closely spaced microresistor sites in an insulator layer of a long Josephson junction. The phase dynamics of a Josephson vortex (or fluxon) may be described using the perturbed sine-Gordon equation. In a uniform electromagnetic field, it is found that the resonant cavity interacts with fluxons only when they are trapped on a microresistor site. The effect of a resonant cavity on the two JVQ's may be represented as a deformation of the two-qubit potential function. We examine the effects of resonant cavity and magnetic induction on the potential for two non-interacting JVQ's. The deformation of the potential due to the resonant cavity yields a significant increase in the two-fluxon tunneling compared to the single-fluxon tunneling, indicating that entanglement between the two JVQ's is significantly increased. We compute the concurrence to estimate how the entanglement is affected by the magnetic induction effect and the coupling between the fluxons and the resonant cavity.

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Date submitted: 27 Nov 2007 Electronic form version 1.4