Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Entanglement of Two Josephson Vortex Qubits in Resonant Cavity RAMESH DHUNGANA, ISAAC O'BRYANT, JU KIM, University of North Dakota — We discuss the entanglement of two Josephson vortex qubits (JVQs) interacting via the magnetic induction effect. A JVQ may be fabricated by implanting two closely spaced microresistors in the insulating layer of a long Josephson junction (LJJ). These two microresistors generate a double-well potential which traps a Josephson vortex (i.e., fluxon). The macroscopic quantum tunneling (MQT) of the fluxon from one well to another gives rise to a two-state system. The magnetic induction effect in a stack of LJJs introduces an asymmetry in the double-well potential and leads to the interaction between the qubits. We compute the MQT of the fluxons between the minima of the symmetric and asymmetric double-well potentials by using the instanton and the valley-instanton approaches, respectively. We compute the concurrence to estimate the level of entanglement of two JVQs. Our result indicates that the entanglement between the two JVQs is significant. Also, we show that the concurrence of the JVQs, placed in a resonant cavity, is enhanced since the cavity acts as a mediator for the interactions between the JVQs. This suggests that the degree of entanglement may be controlled by varying either the resonant frequency or the strength of coupling between the LJJ and cavity.

Ramesh Dhungana
University of North Dakota

Date submitted: 25 Nov 2008 Electronic form version 1.4