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Decoherence in Josephson Vortex Quantum Bits JU KIM, RAMESH DHUNGANA, University of North Dakota, KEE-SU PARK, Pohang University of Science and Technology — We investigated decoherence of a Josephson vortex quantum bit (qubit) in dissipative and noisy environment. As the Josephson vortex qubit is fabricated by using a long Josephson junction (LJJ), we use the perturbed sine-Gordon equation to describe the phase dynamics representing a two-state system and estimate the effects of quasiparticle dissipation and weakly fluctuating critical and bias currents on the relaxation time T_1 and on the dephasing time T_ϕ. We show that the critical current fluctuation does not contribute to dephasing of the qubit in the lowest order approximation. Modeling the weak current variation from magnetic field fluctuations in the LJJ by using the Gaussian colored noise with long correlation time, we show that the time T_2 is limited by the low frequency current noise at very low temperatures. Also, we show that a ultra-long coherence time may be obtained from the Josephson vortex qubit by using experimentally accessible value of physical parameters.

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