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Numerical verification of the instanton method on macroscopic quantum tunneling: phase slip dynamics[1] IPPEI DANSHITA, Department of Physics, Faculty of Science, Tokyo University of Science, ANATOLI POLKOVNIKOV, Department of Physics, Boston University — Instanton methods have been widely used for studying quantum tunneling in various contexts. Nevertheless, how accurate instanton methods are for the problems of macroscopic quantum tunneling (MQT) still remains unclear because of lack of their direct comparison with exact time evolution of the many-body Schroedinger equation. In this talk, we show numerical verification of instanton methods applied to coherent MQT. By specifically applying the quasi-exact numerical method of time-evolving block decimation to the system of bosons in a ring lattice, the real-time quantum dynamics of supercurrents is simulated. There we see a coherent oscillation between two macroscopically distinct current states occurs due to MQT. The tunneling rate extracted from the coherent oscillation is compared with that given by the instanton method. We show that the error is within 10 percent when the effective Planck's constant is sufficiently small. We also discuss phase-slip dynamics associated with the coherent oscillations.

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