Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Thermally activated escape rate for a Brownian particle in a tilted periodic potential for all values of the dissipation: classical and quantum regimes WILLIAM COFFEY, Dept. of Electronic and Electrical Engr., Trinity College, YURI KALMYKOV, MEPS, Université de Perpignan, France, SERGEY TITOV, Inst. of Radio Engr. and Electronics of the Russian Academy of Sciences, Russia, B. MULLIGAN, Dept. of Electronic and Electrical Engr., Trinity College — The translational Brownian motion of a particle in a tilted periodic potential is considered. The classical and semiclassical escape rates of a particle out of the well are estimated both numerically and analytically. In order to accomplish this, the continued-fraction method of solving classical Fokker–Planck equations is adapted to treat quantum master equations of the Caldeira–Leggett type using the phase-space (Wigner) representation of the quantum density matrix as suggested by Garcia-Palacios [J. Phys. A: Math. Gen. **37,** 10735 (2004)]. The numerical escape rates are compared with those obtained in the context of the Kramers theory of the escape rate of a Brownian particle from a potential well as extended by Mel'nikov [Physica A **130**, 606 (1985); Phys. Rep. **209**, 1 (1991).] and Rips and Pollak [Phys. Rev. A **41**, 5366 (1990)] for all values of the dissipation including the very low damping, very high damping, and turnover regimes. It is shown that in the low temperature limit, the universal expressions for the escape rate provide a good estimate of escape rates both in classical and quantum regimes.

William Coffey
Department of Electronic and Electrical Engineering,
Trinity College, Dublin 2, Ireland

Date submitted: 25 Nov 2005 Electronic form version 1.4