

Effective temperature of the fluctuation theorem in single-electron counting

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We investigate the direction-resolved full counting statistics of single-electron tunneling through a double quantum dot system and compare with predictions of the fluctuation theorem (FT) for Markovian stochastic processes. Experimental data obtained for GaAs/GaAlAs heterostructures appear to violate the FT. After analyzing various potential sources for the discrepancy we conclude that the nonequilibrium shot noise of the measurement device influence the tunneling statistics. Taking these modifications into account we show how the FT can be violated due to measurement effects and recovered for fast detection by introducing an “effective temperature.” [Y. Utsumi, D. S. Golubev, M. Marthaler, T. Fujisawa, Gerd Schön, “Single-Electron Tunneling and the Fluctuation Theorem”, arXiv:0911.5469, Y. Utsumi, D. S. Golubev, M. Marthaler, K. Saito, T. Fujisawa, Gerd Schön, “Bidirectional Single-Electron Counting and the Fluctuation Theorem”, Phys. Rev. B 81, 125331-1 - 125331-5 (2010)]