Nonequilibrium Landau-Zener-Stückelberg spectroscopy in a double quantum dot

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We study theoretically nonequilibrium Landau-Zener-Stückelberg (LZS) dynamics in a driven double quantum dot (DQD) including dephasing and, importantly, energy relaxation due to environmental fluctuations. We derive effective nonequilibrium Bloch equations. These allow us to identify clear signatures for LZS oscillations observed but not recognized as such and to identify the full environmental fluctuation spectra acting on a DQD in experiments [1]. We find that the dominant dephasing and relaxation channels vary while driving. In detail, super-Ohmic fluctuations, typically due to phonons, are the main relaxation channel for a detuned DQD while dephasing is due to slow noise. In contrast, at zero detuning Ohmic fluctuations dominate dephasing and relaxation.

[1] K.D. Petersson, J.R. Petta, H. Lu, and A.C. Gossard, Phys. Rev. Lett. **105**, 246804 (2010).