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Finite-frequency shot noise as a spin-relaxation probe in quantum dots FARZAD QASSEMI MALOOMEH, WILLIAM A. COISH, FRANK K. WILHELM, Institute for Quantum Computing and Department of Physics and Astronomy, University of Waterloo, Ontario, Canada, JOAKIM BERGLI, Department of Physics, University of Oslo, Norway — Long spin-relaxation times are an important prerequisite for spin-based quantum information processing. However, conventional pulsed-gate techniques for measuring spin relaxation in a quantum dot operate only at large energy splitting. An alternative is to measure a transient effective charge e^* [1], or equivalently, the zero-frequency noise. However, multi-level systems often exhibit several decay rates due to distinct physical mechanisms, where a more refined approach is necessary. We have formulated a theory of the frequency-dependent current noise through a multilevel system in the dynamical channel blockade regime, including the effects of multiple relaxation processes. This theory gives a one-to-one correspondence between the form of the frequency-dependent Fano factor and the relevant relaxation rates and can therefore be used to determine these rates through a measurement of the current noise. We have applied it to the case of a quantum-dot spin diode (or spin valve) and to a double quantum dot in the Pauli spin blockade regime.

[1] F. Qassemi, W. A. Coish and F. K. Wilhelm, Phys. Rev. Lett. **102**, 176806 (2009)

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