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Measured first-passage-time distributions for a high-dimensional system: noise-induced current switching in semiconductor superlattices[1]

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— We report the experimental measurement of first-passage-time distributions associated with current switching in weakly-coupled GaAs/AlAs superlattices, in a regime of nonlinear electronic transport where the static current-voltage $(I - V)$ curves exhibit multiple branches and bistability. Precision, high bandwidth current switching data are collected in response to sequential steps in applied voltage to a final voltage V_f near to the voltage V_{th} corresponding to the end of a particular branch. For initial state preparation, a double step procedure is used to insure that the system is close to the true metastable state. For a range of V_f values, switching times reveal large stochastic fluctuations driven by internal shot noise. For smaller times ($< 3\mu$s), the switching time distributions show exponential tails, as expected for activated escape from an initial metastable state. However, at larger times ($>$ 10 μs), the distributions exhibit power law tails (with exponent ranging from -2 to -1, and dependent on $|V_f - V_{th}|$). Possible sources for the power law decay include collective effects and the presence of multiple escape trajectories.

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