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Shot noise induced switching of current in one-dimensional bistable resonant tunneling devices OLEG TRETIAKOV, Duke University, KONSTANTIN MATVEEV, Argonne National Lab — Current switching in a double-barrier resonant tunneling structure is studied in the regime where the current-voltage characteristic exhibits intrinsic bistability. In the bistable region of the I-V curve two different steady states of current are possible at each value of bias. Close to the upper boundary V_{th} of the bistable region the upper current state is metastable. The current decays from this metastable to the lower stable state due to shot noise. We find the time of this switching process in one-dimensional structures. The latter are devices whose cross-section has a shape of a strip with the width small compared to its length. As the bias V is tuned away from the boundary value V_{th} of the bistable region, the mean switching time τ increases exponentially. We show that in long strips $\ln \tau \propto (V_{th} - V)^{5/4}$, whereas in short strips $\ln \tau \propto (V_{th} - V)^{3/2}$. The fact that the problem is one-dimensional enables us to obtain analytically exact expressions for both the exponential factor and the prefactor of τ as functions of bias, in-plane conductivity, and length of the strip. Furthermore, we show that, depending on the parameters of the system, the switching can be initiated either in the middle of the strip, or at its end. Work supported by U.S. DOE, Office of Science, Contract No. W-31-109-ENG-38.

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