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Vortex-induced dissipation in current-biased superconducting nanowires LEV BULAEVSKII, MATTHIAS GRAF, CRISTIAN BATISTA, Los Alamos National Laboratory, VLADIMIR KOGAN, Ames Lab and Iowa State Univ.
— We study the dissipation due to vortex crossings in thin current-biased superconducting films with thickness on the order of the coherence length, and with width much narrower than the magnetic Pearl length in thin films. We find that for technologically relevant thin and narrow films or nanowires with width much larger than the coherence length, the barrier for phase slips by creation of temporary normal regions across the entire film width is too big. Thus phase slips become highly improbable. Instead, we propose the process of a vortex crossing the strip from one edge to the other, perpendicular to the bias current, as the dominant mechanism for generalized phase slips resulting in detectable voltage pulses. We derive phase-current relations and predict the amplitude and duration of voltage pulses induced by vortex motion due to thermal fluctuations and bias current. The consequnces for the current-voltage characteristics and the fundamental limitations for dark counts in superconducting nanowire single-photon detectors are discussed.

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