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Phase slip dynamics in uniform mesoscopic superconducting rings

ANTHONY LOLLO, IVANA PETKOVIC, JACK HARRIS, Yale University — We study the dynamics of phase slips in uniform thin mesoscopic superconducting aluminum rings via cantilever torque magnetometry. In the full field range we measure the persistent current of a unique isolated flux-biased ring, which exibits a step at each phase slip. We then focus on a single transition and accumulate the statistics of the phase slip flux values. We find that as temperature is lowered the transition region becomes wider. This is in contrast with the thermally activated phase slip statistics usually observed in weak links, and contrary to the prediction of McCumber and Halperin for thermal activation in uniform rings. We fit the persistent current with Ginzburg-Landau theory in order to extract the relevant system parameters such as coherence length, and then use them to calculate the relevant free energy barrier between metastable states within the same formalism, which sets the phase slip dynamics. We discuss possible scenarios, including the role of temperature-dependent damping.

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