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Measuring the winding number instability in mesoscopic superconducting rings ANTHONY LOLLO, IVANA PETKOVIC, MICHEL DEVORET, LEONID GLAZMAN, JACK HARRIS, Yale University — In equilibrium, a flux-biased superconducting ring occupies a state that is characterized by the integer winding number of its complex order parameter. Transitions between states of differing winding number occur via phase slips of the order parameter. A number of aspects of these phase slips remain poorly understood, including the particular value of flux bias at which the transition occurs, and the particular state into which the system relaxes. We use cantilever torque magnetometry to address these questions by measuring the equilibrium supercurrent in arrays of isolated aluminum rings over a wide range of applied flux and temperature. We fit the measured supercurrent using one-dimensional stationary Ginzburg Landau theory over the entire field range $-B_{c3} < B < B_{c3}$ and for $T_c/2 < T < T_c$. We show that phase slips occur at the critical flux predicted by Ginzburg Landau theory. The value of this critical flux shows the influence of the rings' finite circumference. We find that in all instances the winding number changes by unity; this may be because the dynamics of the switching events are overdamped in these rings.

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