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Scanning SQUID investigation of the suppression of superfluid density in mesoscopic superconducting rings JULIE A. BERT, NICHOLAS C. KOSHNICK, Stanford University, HENDRIK BLUHM[1], Stanford Univeristy, MARTIN E. HUBER, University of Colorado Denver, KATHRYN A. MOLER, Stanford University — We use a scanning SQUID microscope to measure the suppression of the superconducting response of quasi-1D rings specifically designed to exhibit phase winding fluctuations below Tc. Extremely high flux sensitivity as well as a positionable sensor capable of measuring many individual rings and subtracting the background in situ make scanning SQUID ideal for this measurement. The physical ring parameters are carefully controlled during fabrication to reduce the ring's superconducting phase stiffness by tuning the energy spacing of states where a uniform phase winds an integer number of times around the ring. When the energy difference between adjacent phase winding states is approximately equal to the temperature, the superfluid density is suppressed by the contribution of multiple states to the response. We present susceptibility data and a theoretical framework that demonstrate how these fluxoid fluctuations suppress the ring's diamagnetism below Tc.

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