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Study of vortex states and dynamics in mesoscopic superconducting samples with MFM GREGORY POLSHYN, TYLER NAIBERT, VICTOR CHUA, RAFFI BUDAKIAN, University of Illinois at Urbana-Champaign — Vortex states in superconducting (SC) structures, their dynamics and ways to manipulate them are topics of great interest. We report a new method of magnetic force microscopy (MFM) that allows the study of vortex states in mesoscopic SC samples. For the case of a SC ring, which is biased to a half-integer flux quantum, the flux modulation through the ring caused by the motion of the magnetic tip drives the ring between two consecutive fluxoid states. The corresponding current switching in the ring produces strong position-dependent forces on the cantilever. In the regime where the frequency of the thermally activated jumps between fluxoid states is close to the frequency of the cantilever, large changes in the cantilever frequency and dissipation are observed. This effect may be understood as a stochastic resonance (SR) process. These changes in the cantilevers mechanical properties are used to image the barrier energies between fluxoid states. Additionally, SR imaging of the barrier energies are used to study the effect of the locally applied magnetic field from the MFM tip on the barrier heights. We report the results of measurements for Al rings. Further, the same imaging technique can be applied to more sophisticated SC structures such as arrays of Josephson junctions.

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