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Probing and controlling fluxoid states in multiply-connected mesoscopic superconducting structures HRYHORIY POLSHYN, TYLER NAIBERT, RAFFI BUDAKIAN, University of Illinois at Urbana-Champaign — New ways to investigate and manipulate fluxoid and vortex states of mesoscopic superconducting structures are of great interest. The states with multiple vortices or winding numbers could be useful for the study of vortex interactions and interference effects, the braiding of Majorana bound states by winding vortices, and the development of novel superconducting devices. We demonstrate a methodology based on magnetic force microscopy that allows us to induce, probe and control fluxoid states in thin wall structures comprised of multiple loops. By using micromagnet as a source of inhomogeneous magnetic field, we can efficiently explore the configuration space of fluxoid states. Scanning over the structure reveals the energy crossing points of the lowest laying fluxoid states. This is due the strong interaction of cantilever with thermally activated fluxoid transitions at points of degeneracy. We show that measured patterns of fluxoid transitions allow to identify the states, investigate their energetics, and manipulate them. Further, we show that the dynamics of driven fluxoid transitions can be described by stochastic resonance model, which provides a unique way of measuring fluxoid transition rate and related energy barrier for chosen transitions even in complicated structures.

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