

Description of Additional Supplementary Files

Supplementary Movie 1 | Nonequivalent evolution of the superconducting condensate in a single period of sine-wave AC current. Black dots are nanoscale holes in a conformal array. Blue indicates superconducting state, while red indicates normal state. Gray arrows denote directions of flux-quantum motion. In the 1st half-cycle with $I > 0$, the sample changes from the superconducting state into a complete normal state (with zero order parameter), while in the 2nd half-cycle with $I < 0$, the sample cannot fully reach the normal state.

Supplementary Movie 2 | Nonequivalent temperature evolution in a single period of sine-wave AC current. Video showing nonequivalent nucleation and evolution of hot spots with positive and negative current. Blue circles are nanoscale holes in a conformal array.

Supplementary Movie 3 | Dynamic motion of flux-quanta driven by current in a pristine sample exposed to magnetic field. Red dots (with zero order parameter) show flux-quanta. Video showing a dynamic gradient distribution of flux-quanta.