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Flux-quantum-discretized dynamics of intermediate state flux structures in current-driven type-I superconductors G.R. BERDIYOROV, Departement Fysica, Universiteit Antwerpen; Department of Physics, Loughborough University, A.D. HERNANDEZ-NIEVES, Centro Atomico Bariloche, Argentina, M.V. MILOSEVIC, F.M. PEETERS, Departement Fysica, Universiteit Antwerpen, Belgium, D. DOMINGUEZ, Centro Atomico Bariloche, Argentina — Nonlinear flux dynamics in a current-carrying type-I superconductor is studied using Ginzburg-Landau theory. The current induces the intermediate state, where nucleation of flux domains is *discretized to a single fluxoid at a time*, while their final shape (tubular or laminar) and size depend on applied current. The current induces opposite flux domains on opposite edges, and subsequently drives them to annihilation—which is *also discretized*, as a sequence of vortex-antivortex pairs. In the presence of pinning centers, both pinning and depinning processes occur in a single flux-discretized form regardless of the shape and size of the flux configurations. Repulsive centers (i.e., obstacles) can results in splitting of tubular domains and branching of laminar structures or transformation of them into tubular patterns. The discretization of nucleation and annihilation, as well as pinning/depinning processes leaves measurable traces in the voltage across the sample and in locally probed magnetization. The reported dynamic phenomena thus provide an unambiguous proof of a flux quantum being the smallest building block of the intermediate state in type-I superconductors.

G. R. Berdiyorov
Departement Fysica, Universiteit Antwerpen,
Groenenborgerlaan 171, B-2020 Antwerpen;
Department of Physics, Loughborough University

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