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Intermediate state: a new look at an old story[1] VLADIMIR KOZHEVNIKOV, Tulsa Community College, RINKE WIJNGAARDEN, JESSE DE WIT, VU University Amsterdam, CHRIS VAN HAESENDONCK, KU Leuven
— One of the central problems of superconductivity is magnetic structure of vortices and elicitation of microscopic parameters from parameters of the mixed state (MS) in type-II superconductors. Similar problem, i.e. magnetic structure of normal (N) domains and elicitation of the microscopic parameters from parameters of the intermediate state (IS) in type-I materials, is the longest standing problem of superconductivity advanced by Landau in 1930s. We will report on our recent study of the IS in a high purity indium films using magneto-optical imaging, and transport and magnetization measurements. The least expected observation is that the magnetic flux density in N-domains can be as small as nearly 40% of the thermodynamic critical field H_c. This fact contradicts and hence overthrows a paradigm stating that the N-phase is unstable in the fields less than H_c. We will present a new theoretical model of the IS for the first time consistently addressing this and *all* other properties of the IS. Moreover, our model, based on rigorous thermodynamics of the equilibrium flux structure, allows for quantitative determination of the domain-wall parameter and the coherence length. Possible impact of our model on the vortex structure will be discussed.

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