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Quantum tunneling of Normal-Superconducting interfaces in a type-I superconductor SAUL VELEZ, ANTONI GARCIA-SANTIAGO, RICARDO ZARZUELA, JOAN MANEL HERNANDEZ, JAVIER TEJADA, Universitat de Barcelona, Spain, EUGENE CHUDNOVSKY, The City University of New York, New York, USA — The magnetic irreversibility in the intermediate state in various disks of pure type-I superconducting lead (Pb) with structural defects of diverse nature is presented. The results are discussed in terms of the contributions of the shape-dependent geometrical barrier (which is the origin of the so-called topological hysteresis) and the energy barriers associated to stress defects that act as pinning centers on normal-superconductor interfaces (NSI). The effect of the defects is to enhance the capability of the system to trap magnetic flux along the descending branch of the hysteresis cycle driving the system in a set of metastable states that would originate the occurrence of time-dependent phenomena. Magnetic relaxation studies reveal that the dynamics of the intermediate state of a type-I superconductor with defects is ruled by nonthermal processes for low enough temperatures. It is attributed to quantum tunneling of NSI mediated by the formation/flattening of bumps at the defects of the sample. The average value of the tunneling barriers is estimated and the temperature of crossover from the thermal to the quantum regime is obtained from the Caldeira-Leggett theory. Comparison between theory and experiment points to tunneling of interface segments of a size comparable to the coherence length, by steps of the order of 1 nm. Finally, the effect of an applied magnetic field on the quantum dynamics of the system is also explored.

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