Temperatures of Phase-Slip Centers and Hot Spots in current-driven Superconducting Strips

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When carrying a current above the pair-breaking limit, a narrow superconducting wire leaves its homogeneous state, and gets striped into alternating resistance-less and dissipative zones known as Phase-Slip Centers (PSC). Due to dissipation, the latter singularities adopt a core temperature Tm larger than the ambient temperature T0, although they still belong to the superconducting state, which implies Tm below Tc , the critical temperature. Following an additional excitation (an increase in current, or an external excitation), a PSC may switch into a normal Hot Spot (HS), of core temperature TM above Tc. The phonon escape time to the substrate is a fundamental parameter of the problem. By measuring the PSC differential resistance and the PSC nucleation time, one can provide a consistent description of the temperatures reached in the resistive centres of a current-driven superconducting strip. It applies to High-Tc (YBa2Cu3O7) as well as metallic (Nb) materials.