
Near-power-law temperature dependence of the superfluid stiffness in strongly disordered superconductors

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Résumé

We present results of experimental and theoretical studies on the temperature dependence of superfluid stiffness $\Theta(T)$ in strongly disordered pseudo-gaped superconductors. Experimentally, it is demonstrated that temperature-dependent suppression of superfluid density in strongly disordered InOx films follows at $T \ll T_c$ a power-law behavior $\delta\Theta(T) \sim T^b$, with b slightly less than 2. Theoretically, by combining analytical and numerical methods to a model of a disordered superconductor with a pseudogap, we found qualitatively similar low-temperature behavior with exponent $b \sim 2 - 3$ being disorder-dependent. Broad distribution of superconducting order parameter known to exist in such superconductors (1, 2) even moderately far from the superconductor-insulator transition, is important for this result. The obtained results are relevant for the search of superconducting superinductors – devices much wanted for several fields of modern quantum technology.

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