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Charged fluctuators as a limit to the microscopic and macroscopic coherence of superconductors

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By analyzing experiments on thin-film resonators of NbSi and TiN, we elucidate a decoherence mechanism at work in disordered superconductors. This decoherence is caused by charged Two Level Systems (TLS) which couple to the conduction electrons in the BCS ground state, inducing fluctuations of the kinetic inductance. Standard theories of mesoscopic disordered conductors are used to describe this effect, linking electronic (microscopic) decoherence and electromagnetic (macroscopic) decoherence in superconductors. Given the omnipresence of charged TLS in solid-state systems, this decoherence mechanism affects all experiments involving disordered superconductors, and more strongly so devices with smaller cross-sections. In particular, we show it easily explains the poor coherence observed in quantum phase slip experiments and may contribute to lowering the quality factors in disordered superconductor resonators.

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Less than 5 years of experience since completion of Ph.D

N

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