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Coherent Suppression of Quasiparticle Dissipation in Superconducting Artificial Atom[1]

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We demonstrate immunity to quasiparticle dissipation in a Josephson junction. At the foundation of this protection rests a prediction by Brian Josephson from fifty years ago: the particle-hole interference of superconducting quasiparticles when tunneling across a Josephson junction [1]. The junction under study is the central element of a fluxonium artificial atom, which we place in an extremely low loss environment and measure using radio-frequency dispersive techniques [2]. Furthermore, by using a quantum limited amplifier (a Josephson Parametric Converter) we can observe quantum jumps between the 0 and 1 states of the qubit in thermal equilibrium with the environment. The distribution of the times in-between the quantum jumps reveals quantitative information about the population and dynamics of quasiparticles [3]. The data is entirely consistent with the hypothesis that our system is sensitive to single quasiparticle excitations, which opens new perspectives for quasiparticle monitoring in low temperature devices. [1] B. D. Josephson, Physics Letters 1, 251 (1962) ; [2] I. M. Pop et al., Nature 508 (2014) ; [3] U. Vool et al., PRL (in press 2014);

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