Evidence for long-lived quasiparticles trapped in superconducting point contacts

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We use micro-fabricated mechanically controllable break junctions to obtain aluminum point contacts. The current-voltage characteristic of the contact allows to determine precisely the transmissions of its conduction channels, and its current-phase relation.[1][2]We have observed that the supercurrent across phase-biased, highly transmitting contacts is strongly reduced within a broad phase interval around π. We attribute this effect to quasiparticle trapping in one of the discrete sub-gap Andreev bound states formed at the contact.[3] Trapping occurs essentially when the Andreev energy is smaller than half the superconducting gap Δ, a situation in which the lifetime of trapped quasiparticles is found to exceed 100μs. The origin of this sharp energy threshold is presently not understood.

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[3]N. M. Chtchelkatchev and Yu.V. Nazarov, Phys. Rev.Lett. 90, 226806 (2003).