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Strong effects of weak ac driving in short superconducting junctions¹ ROMAN-PASCAL RIWAR, MANUEL HOUZET, JULIA S. MEYER, Univ. Grenoble Alpes, INAC-SPSMS, F-38000 Grenoble, France; CEA, INAC-SPSMS, F-38000 Grenoble, France, YULI V. NAZAROV, Kavli Institute of NanoScience, TU Delft, Lorentzweg 1, NL-2628 CJ, Delft, The Netherlands — We study a short superconducting junction subject to a dc and ac phase bias. The ac modulation changes the occupation of the Andreev bound states formed at the constriction by transitions between bound states and the continuum. In a short junction, the non-equilibrium Andreev bound state population may relax through processes that conserve parity of the occupation number on the same bound state and processes that do not conserve it. We argue that the parity conserving processes occur on a much faster time scale. In this case, even a weak driving may lead to a large deviation of the supercurrent from its equilibrium value. We show that this effect is accompanied by a quasiparticle current which may lead to a measurable charge imbalance in the vicinity of the junction. Furthermore, we study the time evolution of the supercurrent after switching off the ac drive. On a time scale where parity relaxation is negligible, the supercurrent relaxes to a stationary non-equilibrium state. Finally, we briefly outline the regime of ultraweak driving where the ac-induced processes occur on a time scale comparable to parity relaxation.

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