Floquet-Andreev resonances in hybrid superconducting systems

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Résumé

An interesting class of periodically driven condensed matter systems is obtained by coupling one or several quantum dots to a finite number of superconducting reservoirs. A unique feature of such systems is that time-periodicity can be realized by purely dc-voltage biasing of the reservoirs. As a result of the periodic driving, the equilibrium Andreev bound states, localized on the dot, turn into non-equilibrium Floquet-Andreev resonances. The resonances have a finite lifetime due to multiple Andreev reflection (MAR) processes.
We focus on the S-QD-S-QD-S bijunction, also known as the "Andreev molecule". We consider two observables: the MAR current and the time-averaged spectral function, which can be probed by tunneling spectroscopy (1). We then consider the bijunction away from the molecular regime. We find that periodic driving induces a long-range coupling between the dots, resulting in interferometric behavior (2).

(1) A. Keliri and B. Douçot, "Driven Andreev molecule", Phys. Rev. B 107, 094505 (2023)
(2) A. Keliri and B. Douçot, "Long-range coupling between superconducting dots induced by periodic driving, arXiv: 2304.05987 (2023)

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