

Aharonov-Bohm and Aharonov-Casher effects of nonlocal and local Cooper pairs

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Recent experiments show, that it is possible to generate a Josephson supercurrent form by split nonlocal Cooper pairs [1]. This new Josephson current required further studies especially its interference properties. While the behavior of single electrons under the influence of Aharonov-Bohm (AB) and Aharonov-Casher (AC) effects is well understood, it raises the question of the impact of these effects on nonlocal superconducting Cooper pairs which are in spin singlet state. We analyze a normal ring, where a single electron interference is possible and two parallel nanowires connected to two superconducting electrodes, where a single-electron interference can be absent but a cross Andreev reflection is possible. At low transmission, we can link the AB effect only to local Cooper pairs and the AC effect to nonlocal Cooper pair transport.

References:

[1] R. S. Deacon, A. Oiwa, J. Sailer, S. Baba, Y. Kanai, K. Shibata, K. Hirakawa, and S. Tarucha, Nature Communications (6), 7446 (2015)