

Superconducting Dirac point in proximitized graphene

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Two-dimensional (2D) materials have attracted vast research interest since the breakthrough discovery of graphene. One major benefit of such systems is the simple ability to tune the Fermi level through the charge neutrality point between electron and hole doping. For 2D Superconductors, this means that one may potentially achieve the regime described by Bose Einstein Condensation (BEC) physics of small bosonic tightly bound electron pairs. In this work [1] we show that single layer graphene, in which superconducting pairing is induced by proximity to a low density superconductor, can be tuned from hole to electron superconductivity through an ultra-low carrier density regime where the BEC limit is effectively realized. We study, both experimentally and theoretically, the vicinity of this “Superconducting Dirac point” where reflections at interfaces between normal and superconducting regions within the graphene, suppress the conductance. In addition, the Fermi level can be adjusted so that the momentum in the normal and superconducting regions perfectly match, giving rise to ideal Andreev reflection processes.

[1] G. N. Daptary, E. Walach, E. Shimshoni and A. Frydman, arXiv:2009.14603