Cooper Pair Splitting by means of Graphene Quantum Dots

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Abstract
Quantum entanglement is at the heart of Einstein–Podolsky–Rosen (EPR) paradox, which is fundamental for quantum information. Quantum entanglement has been successfully realized in optics, where the experiment benefit from the easy generation of entangled photons. In solid state, however, the progress has been modest. One natural source for quantum entanglement in solid state is split Cooper pairs. A Cooper pair, split out from a superconductor into two different terminals, will form a non-local entangled spin pair [1,2]. We report an experiment on a superconductor-graphene double quantum dot (QD) system, in which we observe Cooper pair splitting (CPS) up to a CPS efficiency of ~ 10% [3]. Comparing to the previous Cooper pair splitters [4-6], we were able to independently tune the bias and the energy levels of the two graphene QDs. Benefit from that, for the first time, the energy levels of the two QDs were tuned to be asymmetric or symmetric with respect to Fermi level in the superconductor. And we observed CPS or elastic co-tunneling favored as theories predicted [7,8]. The realization of CPS in graphene makes it feasible for graphene to be used for quantum information processing.

References

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