

From Majorana to Andreev and back

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Subgap Andreev bound states (ABS)s near zero energy are ubiquitous in semiconductor-superconductor hybrid devices due to various physical mechanisms, making unambiguous Majorana detection extremely difficult. Interestingly, this Majorana versus Andreev controversy [1] has helped us to understand that, far from being a disadvantage, the presence of ABSs can be used to design new qubit concepts. One promising route is to encode a qubit in the spin of a quasiparticle occupying an ABS in a quantum dot-based Josephson junction [2,3]. Embedding such superconducting spin qubit in a superconducting transmon circuit, allows an intrinsic spin-supercurrent coupling providing an optimal interface with circuit quantum electrodynamics for coherent control, readout and strong coherent qubit-qubit coupling [4]. By extending this idea to Josephson junctions based on a minimal chain of four quantum dots one could demonstrate a minimal Majorana-Transmon qubit based on non-local fermion parity [5].

References

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