Induced superconductivity in semiconductor nanowires and quantum dots

Eduardo Lee (Eduardo.lee@uam.es)

When a superconductor is placed in contact with a non-superconducting material, the latter acquires superconducting properties near the interface, including a superconducting gap and the ability to carry supercurrents. This is known as the superconducting proximity effect. In the past years, there has been a growing interest in studying the superconducting proximity effect in semiconductor nanostructures. This interest is partly driven by prospects of novel applications that exploit such a hybrid combination of properties. Some examples include tunable superconducting qubits and sources of entangled electrons, to name a few. Perhaps even more interesting is the fact that hybrid superconductor-semiconductor nanostructures constitute a very promising platform for the realization of Majorana fermion excitations. Such Majorana modes hold potential for applications in decoherence-robust (topological) quantum computing. This work aims to establish the initial steps towards future experiments targeted at studying Majorana modes. The main goal is to study the superconducting properties induced in InAs and InSb nanowires and quantum dots. To this end, the project will involve the fabrication of hybrid devices, as well as low temperature electrical transport measurements.

References

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