Understanding of disorder for enhancement of superconducting topological gap

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Abstract

Progress in the emergent field of topological superconductivity relies on synthesis of new material combining superconductivity, low density, and spin-orbit coupling (SOC). Theory indicates that the interface between a one-dimensional semiconductor with strong SOC and a superconductor hosts Majorana-modes with nontrivial topological properties [1]. We discuss the recent developments in epitaxial growth of Al on InAs nanowires was shown to yield a high-quality superconductor-semiconductor system with uniformly transparent interfaces. We have developed a two-dimensional (2D) surface InAs quantum wells with epitaxial superconducting Aluminum [2], yielding a planar system with exceptional structural and transport characteristics [3]. We present new qubits based on semiconductor weak links dubbed Gatemons. These qubits show great promise on this platform for realization of topological qubits where we unprecedented control over proximity effect in semiconductors using a gate voltage [4]. We discuss the role of disorder and how they could enable potential circuit applications for low power circuits, gate-based topological qubits as well as superconducting qubits for computation [5].

References

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Figures

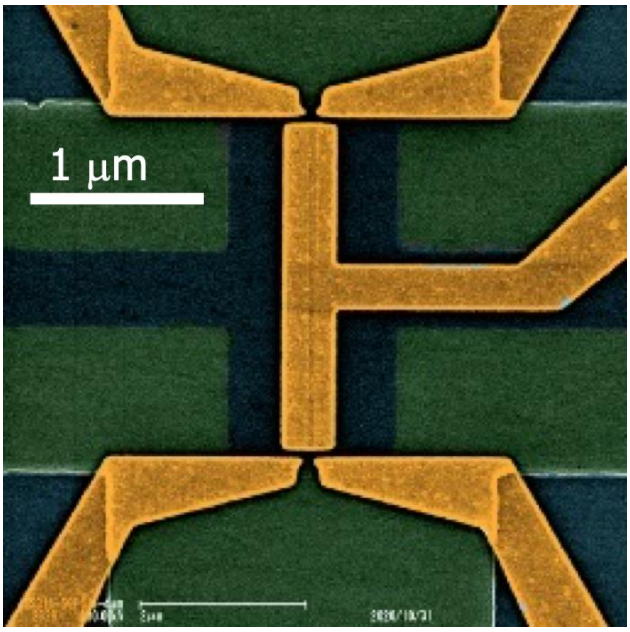

Figure 1: Planar Josephson Junctions exhibiting signatures of topological phase.