Superconductor-semiconductor hybrid circuits on a germanium 2DEG platform

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Hole spin qubits in strained planar germanium quantum wells (Ge/SiGe) have emerged as a promising qubit candidate for quantum information processing and simulation. Recently, hard-gapped superconductivity has been engineered for the first time in Ge/SiGe, in a wide range of mesoscopic devices. The demonstration of an isotopically purifiable semiconductor platform that can host clean superconductivity places Ge/SiGe in a uniquely advantageous position, facilitating many opportunities for hybrid superconducting-semiconducting quantum dots, including high fidelity two-qubit gates, extended range qubit-qubit coupling without the need for resonators, and integration with circuit QED. I will describe our progress toward these goals, including the demonstration of a nanoscale quantum dot proximitized via a PtGeSi superconductor.