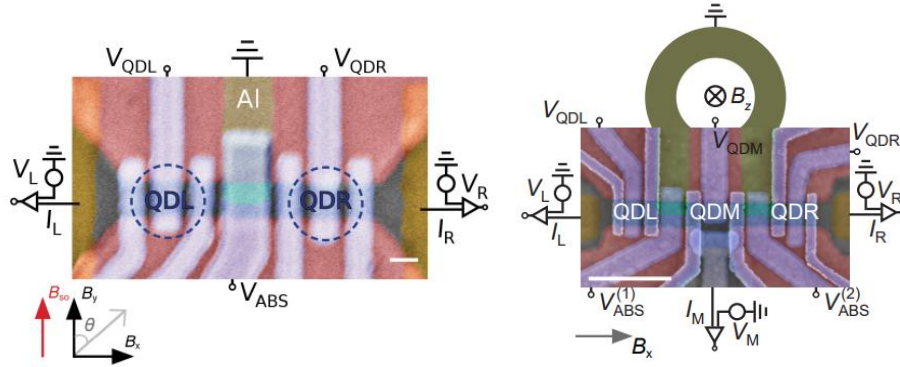


Goswami Lab Open Positions for MEPs

KITAEV CHAINS ON 2DEGS

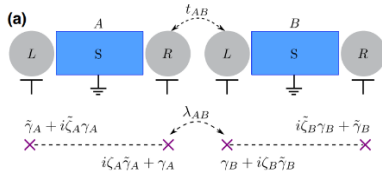
A Kitaev chain made from quantum dots and superconductors is an engineered one-dimensional platform that emulates the Kitaev model for topological superconductivity. In this system, a series of gate-defined quantum dots are tunnel-coupled through superconductors, allowing controlled pairing and hopping couplings. By tuning these couplings, the device can host Majorana zero modes localized at its ends. Such quantum-dot-based Kitaev chains offer a highly tunable, experimentally accessible route to studying Majorana physics and qubits.



A two site Kitaev chain device (Left) [1] and a three site Kitaev chain device (Right) [2].

Potential Project Directions

MINIMAL KITAEV CHAIN QUBITS

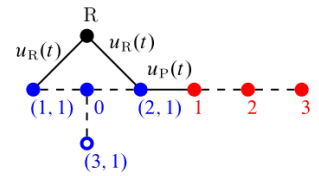


A qubit based on Kitaev chains encodes quantum information non-locally in pairs of Majorana zero modes, making it intrinsically protected from local noise. By manipulating the couplings between these Majorana modes, one can perform topologically robust qubit operations [3].

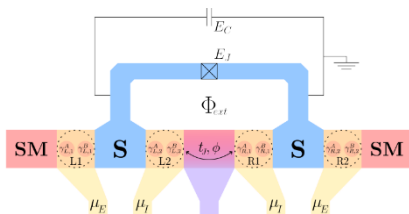
BRAIDING WITH MINIMAL KITAEV CHAINS

Braiding experiments in Kitaev chains aim to exchange Majorana zero modes and observe the resulting non-Abelian transformation of the quantum state.

Demonstrating such braiding would provide direct evidence of topological order [4].



KITMON: KITAEV CHAIN + TRANSMON



We aim to make a new kind of qubit that combines Kitaev chains and transmons together [5]. Researches in our lab including developing Kitaev chains on InAs/Al hybrid systems, and flip-chip technology for cQED experiments.

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[1] Ten Haaf, Sebastiaan LD, et al. *Nature* 630.8016 (2024): 329-334.

[2] Ten Haaf, Sebastiaan LD, et al. *Nature* (2025): 1-6.

[3] Tsintzis, Athanasios, et al. *PRX quantum* 5.1 (2024): 010323.

[4] Boross, Péter, et al. *Physical Review B* 109.12 (2024): 125410.

[5] Pino, D. Michel, et al. *Physical Review B* 109.7 (2024): 075101.