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M3Or3C-03 [Invited]: Development of \pi-periodic Josephson Elements for Charge-Parity Qubits

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Superconducting qubit designs with topological protection against local noise hold the promise of significantly increased coherence times and higher gate fidelities than is possible with conventional qubits. We are developing one such protected qubit design —the hybrid charge-parity qubit —that combines arrays of conventional Josephson junctions and high, but not extraordinarily high, kinetic inductance nanowires made from disordered superconducting thin films arranged into plaquettes to form a \pi-periodic Josephson element. Creating this \pi-periodic Josephson element at the heart of a charge-parity qubit requires particular values of the Josephson energy and charging energy of the junctions and the inductive energy of the nanowires. By varying the magnetic flux in each plaquette, we demonstrate the ability to tune these structures between regimes of 2\pi and \pi periodicity with devices that embed the plaquettes into an rf SQUID.

Primary authors: LIU, Yebin (Syracuse University); Mr DODGE, Kenneth (Syracuse University); Mr SENATORE, Michael (Syracuse University); Dr ZHU, Shaojiang (University of Wisconsin-Madison); Mr NAVEEN, Fnu (University of Wisconsin-Madison); Ms SHEARROW, Abigail (University of Wisconsin-Madison); Mr SCHLENKER, Francisco (Physics, University of Wisconsin-Madison); Dr KLOTS, Andrey (University of Wisconsin-Madison); Prof. FAORO, Lara (University of Wisconsin-Madison); Prof. IOFFE, Lev (University of Wisconsin-Madison); Prof. MCDERMOTT, Robert (University of Wisconsin-Madison); Prof. PLOURDE, Britton (Syracuse University)

Presenter: LIU, Yebin (Syracuse University)

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