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Title: Exploring Nanoscale Josephson Junctions in the Limits of High and Low Charging Energy

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Abstract:

Studies of nanoscale Josephson junctions (JJs) have rapidly increased in recent years due their widespread use in transmon qubits, superconducting tunnel junction (STJ) detectors, nanoscale thermometers, and single electron transistor charge sensors. Traditionally, current-voltage (I-V) behavior has been used as an invaluable tool for probing the physics of tunnel junctions, permitting, for example, studies of disorder. However, in small JJs, measuring I-V curves accurately becomes challenging, as the charging energy (E_c) is comparable to or exceeds the Josephson energy (E_J) and the quantized energy states of the junction dominate transport. To facilitate measurements on nanoscale JJs and to explore the interplay between E_c and E_J, we add shunt capacitors to Al/AlOx/Al JJs possessing critical currents between ~1nA and 50nA (i.e., junction areas between 0.005 μm^2 and 0.10 μm^2), corresponding to the range of devices typical of transmon qubits and single electron charge sensors. In this presentation, we will discuss device fabrication, present transport results, and discuss a transport model for this system.

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