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Investigation of Single and Coupled Flux Qubit Energy Spectra Using Tunneling Spectroscopy ANTHONY PRZYBYSZ, TREVOR LANTING, ANDREW BERKLEY, RICHARD HARRIS, ANATOLY SMIRNOV, MOHAMMAD AMIN, D-Wave Systems Inc., NEIL DICKSON, Side Effects Software Inc., EMILE HOSKINSON, FABIO ALTOMARE, ANDREW WILSON, ELENA TOLKACHEVA, PAUL BUNYK, MARK JOHNSON, GEORDIE ROSE, D-Wave Systems Inc. — We present the results of our investigation of the energy levels of systems of flux qubits using tunneling spectroscopy. Tunneling spectroscopy is a technique by which we use macroscopic resonant tunneling processes of a neighboring qubit to probe the energy spectrum of a system of flux qubits. We used this technique to measure the energy gap of a single qubit near its degeneracy point where it is in a superposition of left and right circulating current states. Furthermore, we applied this technique to systems of up to 8 coupled qubits that were biased at degeneracy and observed energy spectra that agree with theoretical predictions based on independently determined device parameters.

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