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Coupled Qubits for Next Generation Quantum Annealing: Improving Coherence STEVEN WEBER, GABRIEL SAMACH, DAVID HOVER, DANNA ROSENBERG, JONILYN YODER, DAVID K. KIM, ANDREW KERMAN, MIT Lincoln Laboratory, WILLIAM D. OLIVER, MIT Lincoln Laboratory, Research Laboratory for Electronics, Massachusetts Institute of Technology — Quantum annealing is an optimization technique which potentially leverages quantum tunneling to enhance computational performance. Existing quantum annealers use superconducting flux qubits with short coherence times, limited primarily by the use of large persistent currents. Here, we examine an alternative approach, using flux qubits with smaller persistent currents and longer coherence times. We demonstrate tunable coupling, a basic building-block for quantum annealing, between two such qubits. Furthermore, we characterize qubit coherence as a function of coupler setting and investigate the effect of flux noise in the coupler loop on qubit coherence. Our results provide insight into the available design space for next-generation quantum annealers with improved coherence. This research was funded by the Office of the Director of National Intelligence (ODNI), Intelligence Advanced Research Projects Activity (IARPA) and by the Assistant Secretary of Defense for Research & Engineering under Air Force Contract No. FA8721-05-C-0002. The views and conclusions contained herein are those of the authors and should not be interpreted as necessarily representing the official policies or endorsements, either expressed or implied, of ODNI, IARPA, or the US Government.

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