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Superconducting qubits with adjustable coupling, Part I: Architecture YU CHEN, UC - Santa Barbara, C. NEILL, P. ROUSHAN, R. BARENDS, B. CAMPBELL, B. CHIARO, Z. CHEN, A. DUNSWORTH, I. HOI, E. JEFFREY, J. MUTUS, A. MEGRANT, P. O'MALLEY, C. QUINTANA, D. SANK, J. WENNER, T. WHITE, J. KELLY, A.N. CLELAND, J.M. MARTINIS, UC Santa Barbara
— Building a practical quantum computer requires a scalable architecture suitable for large numbers of qubits. A major challenge is to achieve on-demand qubit-qubit interaction, such that turning the coupling off allows isolated single-qubit operations and turning the coupling on allows multi-qubit operations. By combining the high coherence Xmon qubits with an adjustable inductance, we have developed a new qubit architecture called g-mon, which has a tunable qubit-qubit interaction from 10 MHz to -50 MHz. We achieved nanosecond control of the coupling from positive to negative through zero, allowing for a high on/off ratio exceeding 1000. With additional advantages such as high modularity and moderate-distance compatibility, the g-mon architecture provide a potential scalable approch for future quantum computers.

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