Design of a superconducting Josephson junction flux qubit. Tryggvi Ingason, Snorri Ingvarsson, Science Institute, University of Iceland. sthi@hi.is

Among the most promising physical systems for realizing scalable quantum computers is the superconducting qubit. These come in various flavors, one of which is the so-called flux qubit where clockwise and counterclockwise flowing supercurrent in a loop including Josephson junctions represent the basis states for the qubit.

We shall give a brief introduction to some fundamental concepts of quantum computing. We further report on a new and improved design of a flux qubit. These flux qubits have energy level splittings in the vicinity of $\sim$10 GHz and decoherence time up to $\sim 1\mu$s, thus requiring high frequency circuitry. The new design is based on coplanar waveguides as opposed to microstrip lines in previous designs. This helps reduce stray magnetic fields from the various lines, such as those used to "set" the qubit in a certain quantum state and those used to "read" the state after the system has evolved in time. Using these lines, and utilizing symmetry we have designed a qubit where the effect of outside noise sources is reduced and the control and readout signals are optimized.

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