Recent experimental breakthroughs have led to the construction of artificial superconducting ‘atoms’: electrical circuit elements whose state variables (voltages and currents) are intrinsically quantum mechanical. When placed inside a high Q resonator, these ‘atoms’ can strongly interact with single microwave photons. Tests of this new realization of strong-coupling cavity QED are now underway in the lab of Rob Schoelkopf at Yale. In addition to being a new test bed for quantum optics, this architecture has many promising features for quantum computation. We have recently demonstrated high fidelity Deutsch-Josza and Grover search algorithms on a two qubit quantum processor.