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# A Transmon Quantum Annealer: Decomposing Many-Body Ising Constraints Into Pair Interactions


**Abstract:** I am going to introduce the ideas of quantum annealing, a scheme to find solutions to optimization problems. Further I will present the LHZ parity constraint embedding which presents a realistic scheme to build a fully connected ising spin glass hamiltonian as a final Hamiltonian for a experimental quantum annealing device. One of the challenges of the LHZ scheme is to build the four body parity constraints which we further decomposed into two body ising interactions with the help of a new decomposition technique that employs ancilla qubits. These architectural simplifications make it possible to build quantum annealing devices with a wide variety of hardware platforms ranging from atomic systems like Rydberg atoms in optical lattices to solid-state systems like superconducting qubits. In the second part of my talk I present a specific implementation for Transmon qubits. The annealing will be accomplished in the rotating frame with newly designed longitudinal- i.e. Ising interactions based on Josephson ring modulators.