Entanglement Generation via Landau-Zener Interferometry

Jason PETTA
Department of Physics
Princeton University
Jadwin Hall, Room 206
Princeton, NJ 08544 U.S.A.

Abstract:

Landau-Zener interferometry has become a powerful tool for quantum control. I will show how Landau-Zener interferometry can be applied to two distinct physical systems: singlet-triplet spin qubits and cavity-coupled superconducting qubits. We first demonstrate coherent control of electronic spin states in a double quantum dot by sweeping an initially prepared spin singlet state through a singlet-triplet anticrossing in the energy level spectrum. The anticrossing serves as a beam splitter for the incoming spin singlet state. Consecutive crossings through the beam splitter, when performed within the spin dephasing time, result in controllable coherent quantum oscillations between the singlet state and triplet state. Favorable coherence times of superconducting qubits allow us to explore the full crossover from nonadiabatic to adiabatic transition dynamics. We show that we can "throw" a quantum of excitation from one superconducting qubit to another in a cavity coupled system. Single passage through an anticrossing is used to create a Bell state with a fidelity of ~80%, limited by qubit relaxation.

Research performed in collaboration with Guido Burkard, Art Gossard, Andrew Houck, Hong Lu, and Hugo Ribeiro. We acknowledge support from the Sloan and Packard Foundations, ARO, DARPA, and NSF.