Mach-Zehnder-type Interferometry in a Strongly Driven Persistent-Current Qubit

ABSTRACT

Superconducting persistent-current qubits are tunable artificial atoms with multiple energy levels. Single-, two-, and three-photon microwave spectroscopy amongst the lowest-five energy levels was utilized to characterize the qubit’s multi-level energy-band structure, and three-photon coherent oscillations were observed between the ground state and the fourth-excited state. We have also demonstrated Mach-Zehnder-type interferometry with our qubit. The qubit’s ground and first-excited states exhibit an avoided crossing. Strongly driving the qubit with harmonic excitation sweeps it through the avoided crossing two times per period. The induced Landau-Zener transitions act as coherent beamsplitters, and the accumulated phase between transitions varies with microwave amplitude. We have observed quantum interference fringes for 1…20 photon excitations. This talk will present and discuss these experimental results.

The work at Lincoln Laboratory was sponsored by the Air Force Office of Scientific Research under Air Force Contract F19628-00-C-0002. Opinions, interpretations, conclusions, and recommendations are those of the author(s) and are not necessarily endorsed by the United States government.