Observation of Dark State in a Three-dimensional Transmon Superconducting Qutrit

YUHAO LIU, XINSHEENG TAN, DONG LAN, PENG ZHAO, JIE ZHAO, MENGMEI LI, SHUDONG HUANG, HAIFENG YU, SHILIANG ZHU, YANG YU, School of Physics, Nanjing University, China — Dark state refers to a particular state of a quantum system that cannot absorb or emit photons in driving fields. It has important applications in quantum information processing and quantum metrology. Here we report the observation of dark state in a three-dimensional transmon superconducting qutrit. The transmon qutrit, which has cascade three energy levels $|0\rangle$, $|1\rangle$ and $|2\rangle$, is embedded in the center of a rectangle waveguide cavity. When two tone microwaves are applied resonantly between $|0\rangle$, $|1\rangle$ and $|1\rangle$, $|2\rangle$, the state of the system will evolve in time domain. However, if we initialize the qutrit in the coherent superposition state, it will not change with time for certain driving amplitudes. The observed relationship between the initial state and the amplitudes of the two tone microwaves agrees well with the results from numerical calculations.

This work is partially supported by the SKPBR of China (2011CB922104, 2011CBA00205) and NSFC (91021003, 91321310, 11274156).

Yang Yu
School of Physics, Nanjing University, China

Date submitted: 08 Nov 2014