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Observation of Dark State in a Three-dimensional Transmon Superconducting Qutrit[1] YUHAO LIU, XINSHENG TAN, DONG LAN, PENG ZHAO, JIE ZHAO, MENGMENG 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.

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