STIMULATED RAMAN ADIABATIC PASSAGE IN A THREE-LEVEL SUPERCONDUCTING CIRCUIT

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The adiabatic manipulation of quantum states is a powerful technique that opened up new directions in quantum engineering - enabling tests of fundamental concepts such as geometrical phases and topological transitions, and holding a promise of alternative models of quantum computation. Here we benchmark the stimulated Raman adiabatic passage for circuit quantum electrodynamics by employing the first three levels of a transmon qubit. In this ladder configuration, we demonstrate a population transfer efficiency above 80 % between the ground state and the second excited state using two adiabatic Gaussian-shaped control microwave pulses. By doing quantum tomography at successive moments during the Raman pulses, we investigate the transfer of the population in time-domain. Futhermore, we show that this protocol can be reversed by applying a third adiabatic pulse, and we study a hybrid nonadiabatic-adiabatic sequence, which can realize an arbitrary superposition state between the ground state and the second excited state of the transmon. Finally, we present experimental results for a quasi-degenerate intermediate level.

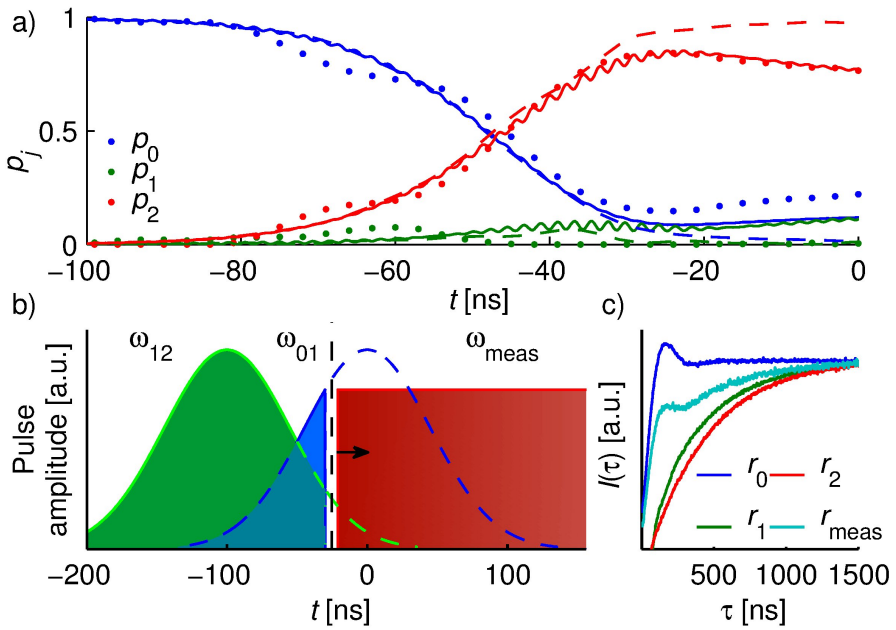

Figure 1: **Quantum tomography of the STIRAP process in a transmon.** a) The state of the quantum system at different times during the adiabatic population transfer. b) Schematic of the pulse sequence during the STIRAP. c) The response of the readout resonator at time t.