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Pairwise kissing of excited states in a squeezed Kerr-oscillator

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Recent advances in the control of superconducting circuits opened new possibilities for the investigation of fundamental quantum phenomena. In this work, we demonstrate the transition into the "Schrödinger-cat regime" of a Kerr-oscillator as it is progressively dressed by squeezed microwave light.
We discover that the lifetime of the degenerate ground states in our experiment increases in steps as a function of the squeezing amplitude. This is a clear signature of pairwise degeneracy (level kissing) in the spectrum of the static effective Hamiltonian describing the system, which we also independently measure. Finally, we measure a lifetime of 1.1ms along one axis of a cat-qubit Bloch sphere, while retaining quantum nondemolition readout fidelities of 99.54% and quantum control. Our experiments provide important tools for analog Hamiltonian engineering and hardware-efficient quantum computation.

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