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Amplitude spectroscopy of a superconducting artificial atom
WILLIAM OLIVER, MIT Lincoln Laboratory, DAVID BERNS, MIT, SERGIO VALENZUELA, CIN2-ICN Barcelona, MARK RUDNER, Harvard, LEONID LEVITOV, TERRY ORLANDO, MIT — We introduce and demonstrate amplitude spectroscopy in a superconducting artificial atom [1]. A harmonic field at a fixed frequency drives the artificial atom through its energy-level avoided crossings. Spectroscopic information is obtained from the amplitude dependence of the system response. The resulting "spectroscopy diamonds," regions of parameters space in which state transitions occur, exhibit quantum interference patterns and population inversion which serve as a fingerprint of the atom's energy spectrum. Using this approach, we determined the energy spectrum of a manifold of states with energies from hx 0.01 GHz to hx 120 GHz for a fixed driving frequency near only 0.16 GHz. The amplitude spectroscopy technique is complementary to frequency spectroscopy, providing a means to access, manipulate, and characterize quantum systems over broad bandwidths while using only a single drive frequency that may be orders of magnitude smaller than the energy scales being probed. [1] Berns et al., Nature 455, 51 (2008)

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