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Time-domain observation of macroscopic quantum coherence VLADIMIR MANUCHARYAN, JENS KOCH, LEONID GLAZMAN, MICHEL DEVORET, Yale Applied Physics — Thirty years ago, A. J. Leggett proposed that a superconducting loop interrupted by a Josephson tunnel junction might display a coherent oscillation between trapping and detrapping of a single flux quantum. This phenomenon of reversible quantum tunneling between two classically separable states of identical energy, known as Macroscopic Quantum Coherence (MQC), is regarded crucial for precise tests of whether macroscopic systems such as circuits fully obey quantum mechanics. We report time-domain observation of MQC oscillations at sub-GHz frequency and quality factor larger than 500. Two major innovations have been introduced to achieve this result: (i) the loop inductance is 10,000 larger than in previous experiments, allowing the junction to enter the charging regime and (ii) a novel microwave cavity-assisted readout scheme free of Purcell effect. Contrary to expectations, we find that the MQC transition could be the basis of a superconducting qubit of improved coherence and readout fidelity.

Vladimir Manucharyan
Yale University

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