

Abstract Submitted  
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**Experimental test of macroscopic realism in a superconducting flux qubit** KOSUKE KAKUYANAGI, NTT Basic Research Laboratories, NTT Corporation, GEORGE KNEE, Department of Physics, University of Warwick, MAO-CHUANG YEH, Department of Physics, University of Illinois, YUICHIRO MATSUZAKI, HIRAKU TOIDA, HIROSHI YAMAGUCHI, SHIRO SAITO, NTT Basic Research Laboratories, NTT Corporation, ANTHONY LEGGETT, Department of Physics, University of Illinois, WILLIAM MUNRO, NTT Basic Research Laboratories, NTT Corporation — A superconducting flux qubit has been considered a macroscopic quantum system because its energy eigenstates correspond to clockwise and anti-clockwise macroscopic current. In order to test macroscopic realism in a superconducting flux qubit, we can measure the violation of the traditional Leggett-Garg inequality (LGI). The LGI is always satisfied if realism is correct, however it can be violated in systems that do not obey realism, for example microscopic systems (atoms, photons) described by quantum mechanics. To show violation of realism in a quantum system, we used a Josephson bifurcation amplifier (JBA) to read out the quantum state of our system in a fast, but low back-action fashion. We tested macroscopic realism with a simplified (but equivalent) LGI and obtained strong and significant evidence for the superposition of states of nontrivial macroscopic objects.

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