

Abstract Submitted
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A two-fold quantum delayed-choice experiment in a superconducting circuit YUAN XU, KE LIU, Tsinghua University, WEITING WANG, Tsinghua Univ, SHI-BIAO ZHENG, Fuzhou University, TANAY ROY, SUMAN KUNDU, MADHAVI CHAND, A. RANADIVE, R. VIJAY, Tata Institute of Fundamental Research, Y. P. SONG, L.-M. DUAN, L. SUN, Tsinghua University — Wave-particle duality is among the most fundamental properties of quantum mechanics. We propose and experimentally demonstrate a two-fold quantum delayed-choice experiment where wave or particle nature of a superconducting interfering device can be post-selected twice after the interferometer. The wave-particle complementarity is controlled by a quantum which-path detector (WPD) in a superposition of its on and off states implemented through a superconducting cavity. The WPD projected to its on state records which-path information, which manifests the particle nature and destroys the interference associated with wave nature of the system. In our experiment, we can recover the interference signal through a quantum eraser even if the WPD has selected out the particle nature in the first round of delayed-choice detection, showing that a quantum WPD adds further unprecedented controllability to test of wave-particle complementarity through the peculiar quantum delayed-choice measurements.

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