Abstract Submitted
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Measuring the phase of a single photon using continuous adaptive measurements[1] LEIGH MARTIN, SHAY HACOHEN-GOURGY, WILLIAM LIVINGSTON, EMMANUEL FLURIN, Quantum Nanoelectronics Lab, Center for Quantum Coherent Sciences, UC Berkeley, HOWARD WISEMAN, Centre for Quantum Dynamics, Griffith University, Brisbane Australia, IRFAN SIDDIQI, Quantum Nanoelectronics Lab, Center for Quantum Coherent Sciences, UC Berkeley — Although phase is an essential property of quantum systems, it does not correspond to an observable in the sense of a standard projective measurement. Nevertheless, there exists a generally accepted canonical phase measurement using the more general formalism of POVMs. A scheme to implement such a measurement in the context of quantum optics has been known for some time [1], but has yet to be demonstrated experimentally. We present progress toward performing a canonical phase measurement on a microwave field which contains a superposition of the vacuum and one photon state. Quantum mechanics necessitates that measurement disturbs the wave function, so it is imperative that one acquire information only about the phase, and not the conjugate variable, amplitude. By operating a Josephson parametric amplifier in phase sensitive mode, we apply quantum feedback to adapt the amplification phase continuously as the photon impinges upon it. This allows us to choose the measurement axis to only acquire information about the relative phase between the zero- and one-photon states. Our work presents a tool for optical communication and highlights an important capability afforded by continuous measurement and quantum trajectories.

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