Abstract Submitted
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Efficient characterization of spurious two-level systems in superconducting qubits under non-ideal conditions[1] MARKKU P.V. STENBERG, Saarland University, YUVAL R. SANDERS, Institute for Quantum Computing and Department of Physics and Astronomy, University of Waterloo, FRANK K. WILHELM[2], Saarland University — The presence of spurious two-level systems (TLSs) is a long-standing problem in superconducting qubits. We present a characterization method that is able to determine both the TLS frequency ω and its coupling strength g with the qubit efficiently. With the method, the mean squared error of the estimates decreases exponentially with the number of measurement shots in contrast to power-law scalings exhibited by the conventional methods. Significantly, our method also works in the presence of decoherence and measurement errors. This is accomplished by applying Bayesian inference in a feedback algorithm that updates the measurement setup based on the previous measurement outcomes while data is being collected. Surprisingly, we find that it is usually possible to characterize ω and g with high precision with only some hundreds of measurement shots - even if the same set of measurements does not allow establishing highly precise expectation values for a quantum state. In addition to TLSs, our method can also be used to precisely characterize stripline resonators.

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