Benedikt Kratochwil

Title: Exploring a three quantum dot charge qubit with a higher order sweet spot.

Abstract:

We implement a single electron charge qubit in a gate defined linear triple quantum dot (TQD) array on a GaAs/AlGaAs heterostructure. The TQD is capacitively coupled to a frequency tunable high impedance SQUID array resonator. The qubit has four control parameters, the strength of the left and right tunnel barriers t_{L} and t_{R} as well as the quadrupolar E_{M} and dipolar detuning δ. We explore a charge qubit operation point which has a third order sweet spot along the detuning parameter δ, however the qubit is susceptible to fluctuations in E_{M}. These so-called sweet spots are beneficial for charge coherence, since the decoherence effects caused by small fluctuations of gate voltages or surrounding charge fluctuators are minimized. We show strong coupling of the qubit to single photons in a frequency tunable high impedance SQUID array resonator. In the dispersive regime we investigate the qubit linewidth in the vicinity of the proposed operating point. In contrast to the expectation of a higher order sweet spot we find a local maximum in the linewidth at the proposed working point. We develop a detailed noise model for this qubit which explains our observations. These results indicate that, in contrast with the original assumption that noise is mostly originating from long-ranged sources, the noise affecting the qubit has a non-negligible contribution coming from short-range noise sources.

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