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Properties and Gate Control of the 0-Pi Qubit, Part 1: Disorder and Coherence[1] PETER GROSZKOWSKI, Department of Physics and Astronomy, Northwestern University, Evanston, IL 60208, USA, AGUSTIN DI PAOLO, ARNE L. GRIMSMO, Institut Quantique and Dpartment de Physique, Universit de Sherbrooke, Sherbrooke, Qubec, Canada, ALEXANDRE BLAIS, Institut Quantique and Dpartment de Physique, Universit de Sherbrooke, Sherbrooke, Qubec, Canada, Canadian Institute for Advanced Research, Toronto, JENS KOCH, Department of Physics and Astronomy, Northwestern University, Evanston, IL 60208, USA — Superconducting circuits are considered one of the most promising architectures for the eventual implementation of quantum information processing devices, and the flexibility they provide has led to many novel qubit designs. One such design, called the 0-Pi qubit [Brooks et al., Phys. Rev. A 87, 52306 (2013)], promises to offer robust protection from spontaneous relaxation and dephasing due to 1/f charge and flux noise. In the case where multiple instances of circuit elements do not have precisely the same characteristic parameters, however, the qubit's degree of freedom couples to a spurious, low-energy harmonic mode, which can lead to new decoherence effects. In this talk we present a theoretical study of the realistic scenario of disorder among circuit element parameters, and discuss the implications of such disorder on the 0-Pi device. We investigate the relevant decoherence channels, identify the limiting one, and present estimates for the resulting coherence times of the 0-Pi qubit in multiple parameter regimes.

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