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Understanding degenerate ground states and protection in new superconducting quantum circuits

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Superconducting quantum circuits have had tremendous success in recent years, paving the way to ever improving fidelities of quantum information processing with solid-state devices. A recent theoretical proposal suggests that a new and simple circuit may produce a qubit with ground state degeneracy [P. Brooks et al., Phys. Rev. A 87, 052306 (2013)]. We report results from a detailed theoretical study of this circuit which elucidate the nature of the spectrum and the low-lying wave functions of this quantum device. We show that the ground state degeneracy is robust to disorder in charge, flux and critical current as well as insensitive to modest variations in the circuit parameters, and conclude with a discussion of future prospects for such protected quantum circuits.

Biography

Jens Koch received his PhD in 2006 from the Freie Universitat Berlin in Germany. After a postdoc appointment at Yale University, he joined the faculty at Northwestern University in 2010. His theoretical work focuses on superconducting quantum circuits and their applications in quantum information processing and quantum simulation.