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Josephson Phase Qubit with a Distributed Reactance: Theory DAVID FERGUSON, ANTHONY PRZYBYSZ, OFER NAAMAN, JOEL STRAND, JAMES MEDFORD, AARON PESETSKI, Northrop Grumman - Baltimore — Recently, the Northrop Grumman's superconducting systems team designed, fabricated, and measured a novel phase qubit in which the shunt capacitance across the Josephson junction and the inductance of the SQUID are provided by a microstrip resonator. To account theoretically for this novel design we treat the superconducting phase drop along the microstrip's length as a continuous field. We present an analysis of this model, describing how the normal modes of the coupled system are influenced by both the applied flux and the microstrip's termination impedance, and how the non-linear coupling of the fundamental "qubit mode" to higher modes generates significant renormalizations of mode frequencies and anharmonicities.

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