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Geometric inductance effects in the spectrum of split transmon qubits R.T. BRIERLEY, J. BLUMOFF, K. CHOU, R.J. SCHOELKOPF, S.M. GIRVIN, Yale University — The low-energy spectra of transmon superconducting qubits in a cavity can be accurately calculated using the black-box quantization approach [1]. This method involves finding the normal modes of the circuit with a linearized Josephson junction and using these as the basis in which to express the non-linear terms. A split transmon qubit consists of two Josephson junctions in a SQUID loop. This configuration allows the Josephson energy to be tuned by applying external flux. Ideally, the system otherwise behaves as a conventional transmon with a single effective Josephson junction [2]. However, the finite geometric inductance of the SQUID loop causes deviations from the simplest ideal description of a split transmon. This alters both the linearized and non-linear behaviour of the Josephson junctions in the superconducting circuit. We study how these changes can be incorporated into the black-box quantization approach and their effects on the low-energy spectrum of the split transmon.

[1] S. E. Nigg et al, Phys. Rev. Lett., 108, 240502 (2012)
[2] J. Koch et al, Phys. Rev. A, 76, 042319 (2007)

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