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Quantum dynamics of triplet superconducting circuits[1] DAVID G. FERGUSON, JENS KOCH, JAMES SAULS, Northwestern University — We generalize the formalism of "circuit quantization" [1] to circuits comprised of spin-triplet superconducting elements. This introduces the dynamics associated with the spin of the Cooper pairs in addition to the phase and charge dynamics. The dynamics of the order parameter for spin-triplet superconductors is encoded in the vector $\vec{d}$ for the spin-projections of the Cooper pairs, which is coupled to the dynamics of the electronic spin polarization, $\vec{S}$. At frequencies below the superconducting gap, $\hbar\omega \ll \Delta$, the classical spin dynamics is described by Leggett's equations for $\vec{d}$ and $\vec{S}$ [2]. Weak spin-orbit coupling ($E_{\text{S-O}} \ll \Delta$) leads to frequency shifts of the normal-state spin resonance. Quantization of a spin-triplet superconducting circuit is achieved by including the Hamiltonian that generates Leggett's equations. Analytical and numerical results for the spectra of the quantized Hamiltonians of varrious circuits are reported. As a case study, we highlight the low energy excitation frequencies of two triplet superconductor islands coupled by a Josephson junction.

[1] M. H. Devoret, Quantum fluctuations in electrical circuits, (Les Houches Session LXIII, 1995).
[2] A. J. Leggett, Rev. Mod. Phys. 47, 331 (1975)

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