
Circuit QED theory of dual Shapiro steps for a Josephson junction coupled to a high-impedance transmission line resonator

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Résumé

We present a theory (1) describing the direct and dual Shapiro steps of a Josephson junction coupled to a multi-mode transmission line resonator. In particular, our theoretical framework is based on a multi-band mean-field treatment of the Josephson Bloch-like dynamics in the presence of both ac and dc driving fields. We show how the metrological quality of the dual Shapiro step quantization depends on the relevant physical parameters of the Josephson junction (capacitive and inductive energies) and of the transmission line (impedance, free spectral range,...), as well as of the driving fields and temperature.

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