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Towards a lossless and integrable circulator for quantum superconducting microwave systems: Theory of operation[1] JOSEPH KERCKHOFF, BENJAMIN J. CHAPMAN, JILA, University of Colorado, KEVIN LALUMIÈRE, ALEXANDRE BLAIS, Université de Sherbrooke, K.W. LEHNERT, JILA, University of Colorado and NIST — Lossless and integrable microwave circulators operating in the 4-8 GHz band are a critical, missing component in superconducting microwave quantum technology. Circulators are non-reciprocal devices used to impose a unidirectional flow of microwave signals. We report on progress towards an all-superconducting microwave circuit potentially capable of integrating with other quantum technologies and replacing many instances of the lossy and non-integrable ferrite circulators used in all contemporary quantum microwave experiments. Non-reciprocity is achieved through relatively weak (sub-Gauss) and slow ($\sim$ 100 MHz) dynamically-modulated magnetic fields that tune the linear susceptibility of SQUID arrays in a four-port, resonant circuit. Our design's basic theory of operation will be covered in this presentation.

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