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Frequency Modulating Entangling Gates[1] THOMAS OHKI, COLM RYAN, BLAKE JOHNSON, KIN CHUNG FONG, Raytheon BBN Technology - Massachusetts, MATT WARE, BRITTON PLOURDE, Syracuse University — There are multiple approaches to generating entangling gates in a superconducting qubit architecture depending on the choice of tunable or fixed frequency qubits. The asymmetric transmon offers a compromise between the two extremes offering mild tunability and better coherence times. With the ability to modulate the qubits' frequency a new type of first-order sideband gate is made available [1,2]. These allow the qubits to exchange information with a cavity quantum bus without having to be dynamically tuned into resonance with the cavity and potentially acquiring unwanted phases from interactions with other qubits. We show progress towards using this interaction as a high-fidelity entangling gate.

[1] Beaudoin, F., da Silva, M. P., Dutton, Z., & Blais, A. (2012). First-order sidebands in circuit QED using qubit frequency modulation. *Physical Review A*, **86**, 022305.
[2] Strand et al. (2013). First-order sideband transitions with flux-driven asymmetric transmon qubits. *Physical Review B*, **87**, 220505.

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