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Manipulating Kerr effects in a superconducting cavity via a superconducting qubit VICTOR V. ALBERT, GERHARD KIRCHMAIR, BRIAN VLASTAKIS, ZAKI LEGHTAS, MAZYAR MIRRAHIMI, S.M. GIRVIN, R.J. SCHOELKOPF, LIANG JIANG, Yale University — Typically, models of qubit-cavity interactions in superconducting circuits have included terms strictly linear in amplitude of the cavity modes. Due to ever-increasing experimental ability to realize larger coupling strengths, induced nonlinearities in the cavity contribute significantly to the dynamics and thus need to be accounted for. Such nonlinearities include interactions between the photon numbers of two cavity modes (cross-Kerr) and between a mode and itself (self-Kerr). Motivated by the recent experimental demonstration of self-Kerr in superconducting cavities, we investigate quantum control of Kerr effects via a dispersively coupled superconducting qubit, which not only enables us to enhance or suppress the Kerr coupling, but also opens the possibility to investigate higher order Kerr effects.

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