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Nonlinearly Coupled Superconducting Lumped Element Resonators MICHELE C. COLLODO, ANTON POTOČNIK, ANTONIO RUBIO ABADAL, MINTU MONDAL, MARKUS OPPLIGER, ANDREAS WALLRAFF, Laboratory for Solid State Physics, ETH Zurich — We study SQUID-mediated tunable coupling between two superconducting on-chip resonators in the microwave frequency range. In this circuit QED implementation, we employ lumped-element type resonators, which consist of Nb thin film structured into interdigitated finger shunt capacitors and meander inductors. A SQUID, functioning as flux dependent and intrinsically nonlinear inductor, is placed as a coupling element together with an interdigitated capacitor between the two resonators (cf. A. Baust *et al.*, Phys. Rev. B **91** 014515 (2015)). We perform a spectroscopic measurement in a dilution refrigerator and find the linear photon hopping rate between the resonators to be widely tunable as well as suppressible for an appropriate choice of parameters, which is made possible due to the interplay of inductively and capacitively mediated coupling. Vanishing linear coupling promotes nonlinear effects ranging from onsite- to cross-Kerr interaction. A dominating cross-Kerr interaction related to this configuration is notable, as it induces a unique quantum state. In the course of analog quantum simulations, such elementary building blocks can serve as a precursor for more complex geometries and thus pave the way to a number of novel quantum phases of light

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