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Towards ultrastrong coupling of superconducting transmission line resonators[1] F. DEPPE, T. WEISSL, E. HOFFMANN, M. HAEBERLEIN, A. BAUST, Walther-Meissner-Institut and TU Muenchen, Garching, Germany, E. MENZEL, M. SCHWARZ, T. NIEMCZYK, A. MARX, Walther-Meissner-Institut, Garching, Germany, D. ZUECO, CSIC-Universidad de Zaragoza, Zaragoza, Spain, J. J. GARCIA RIPOLL, Instituto de Fisica Fundamental, CSIC, Madrid, Spain, R. GROSS, Walther-Meissner-Institut and TU Muenchen, Garching, Germany — Coupled superconducting transmission line resonators have potential applications in quantum information processing and fundamental quantum mechanics. Experimentally, high coupling strengths are desirable for a clear demonstration of quantum effects. We achieve coupling strengths of 10% of the resonator frequency (ultrastrong coupling) by distributed coupling. We find that, differently from the case of point-like coupling, the normal modes are no longer arranged symmetrically with respect to the single resonator frequency. Nevertheless, a detailed theoretical analysis shows that the system can still be described by a beam splitter Hamiltonian for two effective resonators. We expect that this result will allow for straightforward experimental access to exciting effects such as thermal entanglement in our samples.

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