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Circuit Electromechanics with a Non-Metallized Nano- beam MATTHIAS PERNPEINTNER, Walther-Meissner-Institut, Garching, Germany, T. FAUST, Center for NanoScience and Fakultät für Physik, Ludwig-Maximilians-Universität München, München, Germany, F. HOCKE, Walther-Meissner-Institut, Garching, Germany, J.P. KOTTHAUS, Center for NanoScience and Fakultät für Physik, Ludwig-Maximilians-Universität München, München, Germany, E.M. WEIG, Department of Physics, University of Konstanz, Konstanz, Germany, H. HUEBL, R. GROSS, Walther-Meissner-Institut, Garching, Germany — In the field of cavity optomechanics, a motional degree of freedom is coupled to an optical cavity. This approach can be transferred to the solid state environment by combining a superconducting microwave cavity with a nanomechanical resonator. Typically, metallized mechanical resonators are used, coupling capacitively to the microwave cavity. In contrast, non-metallized nanomechanical beams provide higher quality factors and have therefore been employed e.g. for mechanical sensing devices. Here, we present an approach to integrate a pure, i.e. non-metallized nanobeam, into a nano-electromechanical device, which is based on the dielectric coupling between a superconducting coplanar waveguide microwave resonator and a tensile-stressed silicon nitride nanobeam. By making use of the Duffing nonlinearity of the strongly driven beam, we calibrate the amplitude spectrum of the mechanical motion and determine the electromechanical vacuum coupling. We find a quality factor of 480,000 at a resonance frequency of 14 MHz and 0.5 K. We deduce a vacuum coupling of 11.5 mHz, which is in quantitative agreement with finite element based model calculations.

> Matthias Pernpeintner Walther-Meissner-Institut, Garching, Germany

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