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Frequency tuning and coherent dynamics of two nanostring resonators in the strong coupling regime[1] HANS HUEBL, MATTHIAS PERNPEINTNER, PHILIP SCHMIDT, DANIEL SCHWIENBACHER, RUDOLF GROSS, Walther-Meissner-Institut, Bayerische Akademie der Wissenschaften — Coupled nanomechanical resonators are interesting model systems for studying synchronization effects and nonlinear dynamics. This, however, requires the possibility to tune the relevant mode frequencies independently and to operate the resonators in the strong coupling regime. Here, we present a possible realization consisting of two high-quality nanostring resonators, coupled mechanically by a shared support structure. First, we demonstrate that the fundamental mode frequencies of both nanostrings can be tuned independently by a strong drive tone resonant with one of the higher harmonic modes. This technique relies on an effective increase of the pre-stress in a highly excited nanobeam, known as geometric nonlinearity. Using this frequency tuning concept, we investigate the coherent dynamics of the two strongly coupled nanostring resonators. With the two nanobeams tuned in resonance, we observe oscillations corresponding to Rabi oscillations, which indicates coherent excitation transfer between the fundamental modes of the two nanostrings. In addition, experimental investigation of classical Landau-Zener dynamics demonstrates that this coupling and tuning concept paves the way for a selective phonon transfer between two spatially separated mechanical resonators.

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