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Coupling Graphene Mechanical Resonators to Superconducting Microwave cavities

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Graphene is an attractive material for nanomechanical devices because it allows for exceptional properties, such as high frequencies, quality factors, and low mass. An outstanding challenge, however, has been to obtain large coupling between the motion and external systems for efficient readout and manipulation. Here, we report on a novel approach, in which we capacitively couple a high-Q graphene mechanical resonator (Q ≈ 100.000) to a superconducting microwave cavity. The initial devices exhibit a large single-photon coupling of ∼10 Hz. Remarkably, we can electrostatically change the graphene equilibrium position and thereby tune the single photon coupling and the mechanical resonance frequency by a large amount. The strong tunability opens up new possibilities, such as the tuning of the optomechanical coupling strength on a time scale faster than the inverse of the cavity line width. With realistic improvements, it should be possible to enter the regime of quantum optomechanics.