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Femtogram Doubly Clamped Nanomechanical Resonators Embedded in a High-Q Two-Dimensional Photonic Crystal Nanocavity

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We demonstrate a new optomechanical device system which allows highly efficient transduction of femtogram nanobeam resonators. Doubly clamped nanomechanical resonators with mass as small as 25 fg are embedded in a high-finesse two-dimensional photonic crystal nanocavity. Optical transduction of the fundamental flexural mode around 1 GHz was performed at room temperature and ambient conditions, with an observed displacement sensitivity of 0.94 fm/Hz^(1/2). Comparison of measurements from symmetric and asymmetric double-beam devices reveals hybridization of the mechanical modes where the structural symmetry is shown to be the key to obtain a high mechanical quality factor. Our novel configuration opens the way for a new category of "NEMS-in-cavity" devices based on optomechanical interaction at the nanoscale.

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