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Linear Coupling between Transverse Modes of a Nanomechanical Resonator PATRICK TRUITT, Montclair State University, JARED HERTZBERG, University of Maryland, KEITH SCHWAB, California Institute of Technology — Recently, several groups have identified a linear coupling between different vibrational modes of nanomechanical resonators. We report observations of such a coupling between the two transverse modes of a doubly-clamped Si_3N_4 resonator with transverse resonance frequencies of 8.4 and 8.7 MHz. The resonator is voltage biased with respect to a nearby gate electrode for capactive readout. Increasing the gate bias introduces an electrostatic contribution to the spring constant of each mode, reducing the frequency gap between the two modes. At degeneracy, we observe an avoided crossing of 100 kHz. Measurements of the displacement amplitudes and quality factors through degeneracy is consistent with a linear superposition of the two modes. Magnetomotive measurements, which are sensitive to the projection of each mode's displacement onto an applied field, show that the coupled modes remain linearly polarized, with the direction of polarization rotating with increasing gate bias. In an effort to identify the source of the coupling, we constructed a finite element model of the resonator-gate capacitance and find that the observed coupling is an order of magnitude larger than what is expected from electrostatic gradients alone.

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