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Nonlinear Optomechanics: Two-phonon cooling and squeezing ANDREAS NUNNENKAMP, KJETIL BØRKJE, JACK HARRIS, STEVEN GIRVIN, Yale University — Motivated by recent optomechanics experiments using the membrane-in-the-middle geometry [Thompson *et al.*, Nature **452**, 06715 (2008)] we explore the physics of optomechanical systems where the mechanical oscillator is coupled quadratically rather than linearly to one mode of the optical cavity field. We derive an expression for the minimal phonon number achievable by two-phonon cooling, explain how to achieve mechanical squeezing by driving the cavity on both sidebands and calculate the squeezing spectrum of the output cavity field.

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