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Quadratically-coupled optomechanical systems: spectrum and dynamics M. BHATTACHARYA, H. SHI, Department of Physics, Rochester Institute of Technology, Rochester, NY 14623 — Optomechanical systems, which commonly involve a high finesse optical cavity coupled to the linear displacement of a mechanical oscillator, are currently of great interest for applications in quantum information, communication and measurement. Recently instead, a coupling quadratic in the mechanical displacement has been engineered in various systems. These include resonator setups with membranes, cold atoms and microdisks. Neglecting at first dissipation and noise, we present the exact eigenstates of the generic quadratic optomechanical Hamiltonian, examine the corresponding spectrum in the limit of strong coupling, quantify the bipartite entanglement in the system, and describe the unitary-evolution as well as measurement-based engineering of nonclassical states of the system. We show that several of our results are in qualitative contrast with those from the case of linear optomechanical coupling and address briefly the presence of dissipation and the case of quartic coupling recently realized using a tilted membrane in a cavity.

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