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Deterministic macroscopic quantum superpositions of motion by quadratic optomechanical coupling HUATANG TAN[1], University or Arizona, FRANCESCO BARIANI, University of Arizona, GAOXIANG LI, Huazhong Normal University, PIERRE MEYSTRE, University of Arizona — We propose a scheme to prepare macroscopic quantum superpositions of motion of nanomechanical oscillators coupled quadratically to a driven cavity field. These superpositions result from the fact that the nonlinear optomechanical coupling can lead to an effective degenerate three-wave mixing of the mechanical and cavity modes. We show analytically and confirm numerically that different kinds of quantum superpositions can be realized deterministically, depending on the initial mechanical state. The effect of mechanical damping is also quantified by the negativity of the Wigner function. Besides various optomechanical systems, the present scheme could also be applied to other physical systems in which degenerate three-wave mixing can be engineered.

[1]Visiting Researcher from Huazhong Normal University

Lukas Buchmann
University of Arizona

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