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**Using Lie Algebras to Extract Non-Classical Evolution in Optomechanics** ALBERTO ACEVEDO, California State University, San Bernardino and Brigham Young University, TY BEUS, MANUEL BERRONDO, JEAN-FRANCOIS S. VAN HUELE, Brigham Young University — The task of finding the time evolution of quantum systems governed by time-dependent, noncommuting Hamiltonians  $[H(t), H(t')] \neq 0$ , is generally quite complex. Factorization of the evolution operator into time-dependent exponential functions of the time-independent basis elements of the Lie algebra constructed from the Hamiltonian, makes it possible to separately resolve the issues of operator ordering and time-dependence. We apply this method to oscillator dynamics and obtain analytic results. We then consider optomechanical systems, consisting of coupled optical and mechanical oscillator modes to study the generation of non-classical states. We also show how the same method allows for the inclusion of dissipative effects.

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