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Quantum back-reaction from non-adiabatic changes CURTIS ASPLUND, DAVID BERENSTEIN, UC Santa Barbara — Motivated by the problem of thermalization in QFTs and the dual non-equilibrium BH dynamics, we examine a generic and non-trivial aspect of these phenomena, non-adiabatic changes, in a highly simplified setting. We consider a harmonic oscillator whose frequency depends on a second quantum variable x. Beginning with a classical analysis, we show how the system can be described by an improved adiabatic expansion with a velocity dependent force for x. We find an instability at a critical velocity beyond which the adiabatic (Born-Oppenheimer) approximation breaks down. We extend this calculation to the fully quantum system and to field theory and describe how to study fermions with similar techniques. Finally, we set up a model with an abrupt change in the oscillator whose quantum mechanics can be solved exactly so that one can study the effects of back-reaction of a fully non-adiabatic change in a controlled setting. We comment on applications of these general results to the physics of D-branes, inflation, and BHs in AdS/CFT.

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