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Shortcuts to adiabaticity in classical and quantum processes for scale-invariant driving[1] SEBASTIAN DEFFNER, CHRISTOPHER JARZYNSKI, Univ of Maryland-College Park, ADOLFO DEL CAMPO, Theoretical Division and Center for Nonlinear Studies, Los Alamos National Laboratory, Los Alamos —
All real physical processes in classical as well as in quantum devices operate in finite-time. For most applications, however, adiabatic, i.e. infinitely-slow processes, are more favorable, as these do not cause unwanted, parasitic excitations. A shortcut to adiabaticity is a driving protocol which reproduces in a short time the same final state that would result from an adiabatic process. A particular powerful technique to engineer such shortcuts is *transitionless quantum driving* by means of counterdiabatic fields. However, determining closed form expressions for the counterdiabatic field has generally proven to be a daunting task. In this paper, we introduce a novel approach, with which we find the explicit form of the counterdiabatic driving field in arbitrary scale-invariant dynamical processes, encompassing expansions and transport. Our approach originates in the formalism of generating functions, and unifies previous approaches independently developed for classical and quantum systems. We show how this new approach allows to design shortcuts to adiabaticity for a large class of classical and quantum, single-particle, non-linear, and many-body systems.

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