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Exact nonadiabatic steering of quantum particles between arbitrary instantaneous eigenstates of time-dependent Hamiltonians RAFAEL HIPOLITO, PAUL GOLDBART, Georgia Institute of Technology — We consider a system governed by a Hamiltonian $H[R_n]$ that depends on a set of parameters $R_n(t)$ that can be varied with time. We address the task of steering this system between a pair of eigenstates, one corresponding to $H[R_n(t_i)]$, the other to $H[R_n(t_f)]$. For any parameter history connecting $R_n(t_i)$ and $R_n(t_f)$, we formulate a measure of success with this task, based on a path-integral expression for the overlap between the time-evolved initial state (as driven by $H[R_n(t)]$) and the final state, which is obtained by integrating out the system degrees of freedom but which retains a dependence on the parameter history $R_n(t)$. We discuss various settings in which this program may be carried out with perfect accuracy, by optimizing the measure ofsuccess with respect to the parameter history. The task may be accomplished over timescales that are much shorter than simple adiabaticity would require and are on the order of the intrinsic timescale of the system dynamics. For illustration, we consider the example of a particle (possibly with internal freedoms) that is confined by a harmonic potential having time-varying center, curvature and squeezing parameters , for which we determine the parameter history required to steer the particle with perfect accuracy.

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