Abstract:
An optimal control theory is formulated for open quantum systems. Within the Bloch-Redfield formalism we derive a Markovian master equation describing the evolution of open quantum systems in the presence of an external field (the “control”). We show how the decay rates depend on the control field. One can accelerate the relaxation of an open physical system, decelerate it or one may be able to even suppress relaxation altogether. The control-dissipation correlation and a non-perturbative treatment of the control field are essential for reaching this goal. The optimal control problem is formulated within the Pontryagin minimum principle. As an application, we study the dynamics of a spin–boson model in the strong coupling regime under the influence of an external control field. We show how dynamic localization and the inversion of population can be achieved by an optimized control. We will also discuss the implementation of the Hadamard gate.

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