Quantum Coherence via Smooth Optimal Control

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Abstract

We present pulse shaping techniques that allow us to control coherence properties of many-body quantum systems with external time-dependent fields that contain only a few predefined frequency components. By doing this, we respond to experimental challenges in implementing the broad band pulses typically generated with existing optimal control algorithms like GRAPE [1].

With our approach we target the design of control pulses for the manipulation of ensembles of NV centers and the interaction of such ensembles with electro-magnetic resonators [2, 3]. We construct high fidelity quantum gates for ensembles with broadly distributed resonance frequencies and coupling strengths to the control field. In particular, we discuss how the ensemble's dynamics can be restricted to regions of state space with high quantum coherence. Given the comparatively simple pulse shapes generated with our approach, this investigation shall provide an intuitive understanding of the control pulses' functionality.

References

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