Unlocking Quantum Correlations and Coherence in Double Quantum Dots for Scalable Solid-State Qubits

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Abstract

Solid-state systems have emerged as highly promising options for constructing qubits in the field of quantum technologies. Among these systems, double quantum dots (DQDs) have attracted considerable attention due to their versatility and potential for scalable qubit implementation. In this presentation, our primary focus will be to explore the quantum properties exhibited by DQDs, which make them particularly well-suited for advancing quantum technologies. We will delve into the impact of environmental factors on the quantum resources of DQD-based qubits, with a specific emphasis on quantum correlations and coherence. Our discussion will encompass various strategies for creating qubits using quantum dots, and we will present our research findings regarding the utilization of these resources. To quantitatively assess these properties, we will employ a range of quantum quantifiers, including local quantum uncertainty, local quantum Fisher information, and l1-norm coherence. Through our comprehensive analysis, our objective is to identify adjustable control parameters that can effectively preserve quantum correlations and enhance coherence even in the presence of diverse sources of noise. By highlighting the potential for manipulating quantum correlations and coherence within solid-state systems, our presentation will pave the way for the development of practical quantum technologies.

Keywords— Quantum Dots, Quantum Correlations, Quantum Coherence, Quantum Control

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