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Title:	Charger-Assisted Quantum Batteries in Open Environment
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Abstract:	Miniaturization of electronic devices in the current times has triggered the development of small-sized quantum devices, such as quantum batteries. Quantum batteries play a sig- nificant role in the storage of energy, which can be extracted whenever needed. They offer potential advantages over their classical counterparts, in power storage and utilization. This thesis studies the dynamics of quantum batteries attached to an auxiliary, in an open envi- ronment, with primary focus on understanding the charging and discharging behavior, and optimal charging times of such quantum batteries. Through an investigation of coupling dynamics and the use of anharmonicities, the study uncovers correlations between system properties and charging efficacy. The examination of various coupling mechanisms between the battery, charger and aux- iliary affects the charging efficiency and the amount of energy that can be extracted from the quantum battery. By tweaking the coupling strengths, the study identifies strategies to enhance charging timescales, emphasizing the role of coupling mechanisms in the design of batteries. Furthermore, the incorporation of anharmonicities into the charger-battery system shows promising advantage in charging dynamics in certain parameter regimes. Supported by ex- perimental demonstrations and theoretical models, the study highlights the advantages of non-linearities in optimizing energy extraction and utilization efficiency. In summary, this research shows that it is important to consider both coupling dynamics and anharmonicities in the design and performance of quantum batteries. By addressing fundamental questions regarding system behavior under different parameter regimes, this study lays a foundation for understanding quantum energy storage and utilization technolo- gies in the presence of non-linearities and offers insights into the field.
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