Title:	Monitoring-Enhanced Autonomous Quantum Error Correction with Jumptime Readout
Authors:	Vashisht, Pratiyush
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Abstract:	The report aims to investigate the recently proposed "Approximate Autonomous Quan- tum Error Correction (AQEC)" scheme, which is enhanced by monitoring. This en- hancement enables the utilization of the jump time ensemble averaging method. AQEC is designed to safeguard logical qubits against environmental noise through environmental engineering, thereby circumventing the necessity for frequent error- prone measurement feedback loops. The focus is on the bosonic code space, where single-photon loss is predominant. We examine an approximate AQEC scheme that relaxes the stringent Knill-Laflamme (KL) conditions, resulting in an optimal code space composed of Fock states |2􀀀 and |4􀀀 with a Hamiltonian distance of (d = 1). Despite the approximate nature of this code, it effectively mitigates single-photon loss. However, numerical analysis reveals an initial decline in the mean fidelity due to the code's transitional inefficiency. This study demonstrates that this decline, in- dicative of reversible fidelity loss, can be alleviated by employing jump time ensem- ble averaging of quantum trajectories. This approach entails averaging over fixed counts of quantum jumps rather than fixed time, offering an alternative perspective on trajectories that enhances performance. We compare analytical and numerical methodologies, leading to insightful conclusions for future research.
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