

Open Quantum Systems under Coherent Control with Continuous Monitoring and Unitary Feedback

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Abstract: The screening of quantum properties against environmental noise is a key issue in the advancement of quantum technologies. While coherent control techniques are well-established, it has been shown that they can counteract dissipation only to a limited degree. We investigate to what extent continuous monitoring and unitary feedback can improve the stabilization of quantum properties. To this end, we monitor single two-level atom quantum trajectories in the presence of spontaneous decay. Already without feedback, we find that - in contrast to unmonitored systems - arbitrary pure states can be stabilized by post-selecting on the measurement outcomes. Employing unitary feedback, any desired qubit state can be rendered stationary. As we show, this still remains mainly valid when realistic assumptions, such as perturbed control Hamiltonians, inefficient monitoring, and time-delayed feedback are taken into account.