Abstract Submitted
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Continuous protection of a quantum state from motional dephasing OFER FIRSTENBERG, Weizmann Institute of Science — We present a scheme for protecting a qubit from inhomogenous dephasing. The scheme relies on continuously dressing the qubit with an auxiliary state, which exhibits an opposite and potentially enhanced sensitivity to the same source of inhomogeneity. We study dressing configurations with either single or two drive fields. The latter offers robustness to drive noise, similarly to the double-dressing technique in continuous dynamical decoupling. We outline the minimal and optimal conditions for protection. As an experimental case study, we focus on motional dephasing of a spin wave in an atomic ensemble. We employ light storage and retrieval for quantifying the coherence time, which without protection is limited by the ballistic atomic motion at random velocities along the spin wave. When applying the protection scheme, the effect of the drive field can be understood as a velocity-dependent light shift, maintaining the correlations between position and phase of the spin wave. We demonstrate complete suppression of the inhomogeneous dephasing. Our scheme is applicable to various gas, solid, and engineered systems suffering from dephasing due to slow variations of conditions in either time, space, or other domains.

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