

Bosonic Noise Suppression with Qumode-Qubit Rotations

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Bosonic-noise suppression is crucial for reliable continuous-variable (CV) quantum computation. We propose a feasible interferometric protocol to suppress thermal and displacement noise in bosonic codes using conditional-Fourier (CF) rotation gates that entangle the bosonic mode to an (DV) atomic ancilla. Our protocol is both code- and noise-parameter independent and shows that near-unit suppression fidelities are achievable with greater-than-half success probabilities for reasonable noise rates. Moreover, for even bosonic-code choices, a single CF gate is sufficient to achieve such high fidelities that remain completely resilient to DV ancilla amplitude- and phase-damping noise, which is typical in cavity-atomic systems—a huge practical advantage compared to previous methods.