Exploiting symmetries in bosonic codes for quantum error mitigation and correction

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Abstract
Continuous-Variable Quantum Error-Correcting Codes (CV-QECCs) have garnered significant attention as a promising approach for combating decoherence in quantum information processing [1]. In this talk, I will present an overview of the fundamental properties of CV-QECCs—namely, their inherent translational and rotational symmetries [2, 3]—and discuss how these features can be leveraged to develop new error mitigation and correction protocols [4,5,6]. I will also highlight a conceptual link between non-Markovian dynamics and autonomous bosonic QEC procedures [7].

References

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Figures

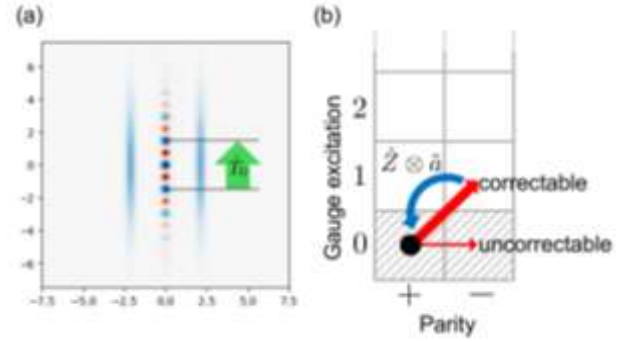

Figure 1: Translational symmetry of squeezed cat codes. (a) Wigner function of the SC state and its translational symmetry.
(b) Subsystem decomposition of the bosonic Hilbert space. The photon loss process (red arrows) changes the parity and partially generates an excitation in the gauge space.
Our proposed QEC protocol (blue arrow) approximately dissipates back to the SC code space (shaded area), along with the parity change, and thus appropriately corrects the correctable part of the photon-loss error.