Gottesman-Kitaev-Preskill State Preparation Using Periodic Driving

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The Gottesman-Kitaev-Preskill (GKP) code may be used to overcome noise in continuous variable quantum systems [1]. However, preparing GKP states remains experimentally challenging [2-5]. We propose a method for preparing GKP states by engineering a time-periodic Hamiltonian whose Floquet states are GKP states. This Hamiltonian may be realized in a superconducting circuit comprising a SQUID shunted by a superinductor and a capacitor (see Fig. 1), with a characteristic impedance twice the resistance quantum. The GKP Floquet states can be prepared by adiabatically tuning the frequency of the external magnetic flux drive (see Fig. 2). We predict that highly squeezed >11.9 dB (10.8 dB) GKP magic states can be prepared on a microsecond timescale, given a quality factor of 10^6 (10^5) and flux noise at typical rates. This work fits into the conference topic of 'Quantum Computing and Technologies' and applies techniques from Quantum Matter such as Floquet engineering. A preprint of this work is available at arXiv:2303.03541 and has been accepted to be published in Phys. Rev. Lett.

References

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Figures

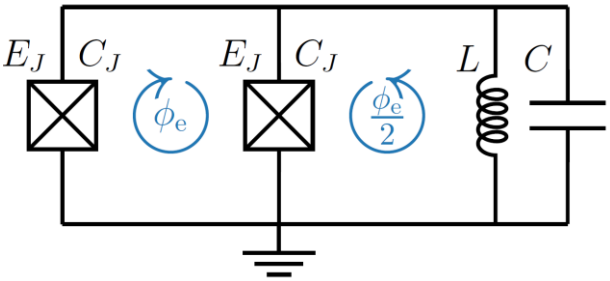

Figure 1: Superconducting circuit diagram for GKP state preparation

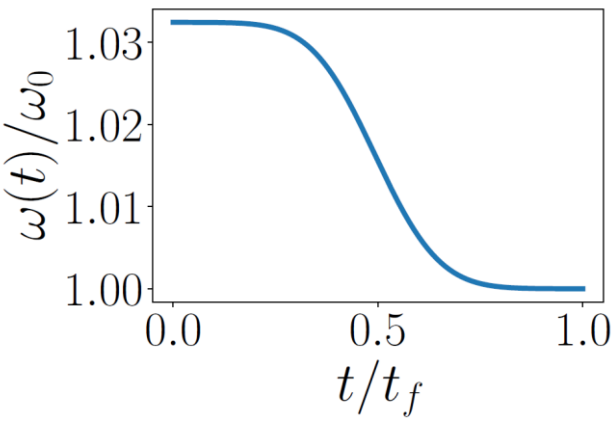

Figure 2: Adiabatic frequency ramp for external magnetic flux drive (denoted by ϕ_e in Fig. 1) to prepare GKP states