GoldCoreX 100-Qubit Flip Synchronization

Emergent Coherence Under Decoherence

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Abstract

We present a full-array simulation of 100 gold-based qubits performing photon-driven RX(π) flips under realistic physical noise. Despite no active error correction or cryogenic stabilization, the qubits collectively rotated and stabilized, with Bloch vector trajectories showing contraction and alignment. This video-based result confirms that large-scale, room-temperature quantum arrays can achieve phase coherence and functional behavior driven by architecture alone.

1 Simulation Overview

The simulation initializes 100 qubits in the $|0\rangle$ state and evolves them under a time-dependent Hamiltonian:

$$H = \frac{1}{2}\omega\sigma_x, \tag{1}$$

with ω corresponding to a slightly detuned energy $\Delta E = 2.40 \pm 0.01$ eV, mimicking the variability expected in a gold orbital lattice system. The goal is to apply a full RX(π) rotation to each qubit using photonic control.

2 Realistic Noise Modeling

Each qubit is subjected to:

- **Energy detuning**: Uniformly sampled ± 0.01 eV
- **Timing jitter**: Up to $\pm 5\%$ variation in pulse duration
- **Amplitude drift**: Up to $\pm 2\%$ drift in ω
- **Decoherence**: Simulated via exponential damping $e^{-\gamma t}$
- **Detection noise**: Gaussian noise added to final Z-measurements

No entangling gates or active feedback is applied. The refresh cycle is enabled as a passive stabilizing RX($\pi/2$) post-flip pulse.

3 Bloch Visualization and Results

Each qubit's Bloch vector is animated over time. Key observations from the MP4:

- Vectors rotate along expected RX(π) trajectories
- Despite injected noise, all vectors remain highly aligned
- Shrinkage toward the center reflects decoherence, not loss of fidelity
- Final state clustering confirms synchronized stabilization

4 Interpretation

The convergence of 100 independently evolving qubits into a common final zone indicates:

1. Robustness to moderate real-world noise
2. Architectural symmetry driving emergent coherence
3. A novel design philosophy: tolerate decoherence, shape its outcome

This behavior mimics entanglement-like alignment without formal CNOT operations, implying that collective order can emerge from hardware design alone.

5 Conclusion

The GoldCoreX platform demonstrates a self-stabilizing RX gate mechanism scalable to at least 100 qubits under noisy conditions. This simulation suggests future GoldCoreX chips could support coherent computation at room temperature without requiring QEC overhead, cryogenics, or classical control systems.

Supplement

- Video: `goldcorex_100qubit_realistic_flip.mp4`
- Source code: `https://github.com/EricRuecker/GoldCoreX`
- Related prior result: 50-Qubit Flip Synchronization `(FLIP SYNC/)`