Contribution ID: **23** Type: **not specified**

Single-qubit gate decomposition stable to Rabi-frequency fluctuations

Monday, 27 May 2024 12:50 (20 minutes)

Single-qubit quantum gates in neutral-atom quantum computers are implemented via Rabi oscillations. An atom is excited by radio-frequency pulses or Raman-laser beams. From one execution of a quantum circuit to another, the Rabi frequency may fluctuate leading to degraded accuracy of single-qubit gates. One of fluctuation reasons is the thermal motion of an atom inside a dipole trap and the dependence of the intensity of the control radiation on the coordinate of the atom in space.

We explore decompositions of single-qubit gates into sequences of rotations about the X and Y axes, seeking stability against Rabi-frequency fluctuations. By considering small perturbations in the Rabi frequency, we develop a robust decomposition for gate operations that minimizes the sensitivity to such fluctuations, extending the fidelity of quantum gates beyond traditional decompositions.

We evaluate different decomposition strategies through numerical simulations using the NLopt optimization library, comparing their performances and stabilities. Additionally, we present experimental results, evaluating our decompositions on neutral-atom computer developed at MSU.

Primary authors: STRUCHALIN, Gleb (Lomonosov Moscow State University, Quantum Technology Centre); MIKHAILOVA, Varvara (Lomonosov Moscow State University)

Presenter: STRUCHALIN, Gleb (Lomonosov Moscow State University, Quantum Technology Centre)