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Fidelity Comparison of Geometric Rotation and Dynamic Rotation MAHMOUD LABABIDI, JASON LEE, MINGZHEN TIAN, George Mason University — In a two-dimensional Hilbert space,the qubit state can be controlled in the Bloch sphere by rotating the Bloch vector about two perpendicular axes of the Bloch sphere. In a two-level atomic system, these basic rotations can be performed through laser-driven quantum state evolutions, which can be dynamic or geometric. Dynamic rotations are usually realized by control Hamiltonians made of a simple laser pulse driving the quantum system through dynamic evolution. Geometric rotations based on the quantum geometric phase are usually designed using multiple pulse sequences. They rely on the global geometry of the evolution which are immune from certain types of local disturbances on the driving Hamiltonian caused by phase and amplitude noise on the control laser pulse. Through theoretical analysis we compare the dynamic rotation fidelity and geometric rotation fidelity. We optimize the parameters of each rotation, to determine the range of high-fidelity in each type of the geometric rotation.

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