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Pulse Shaping Entangling Gates and Error Supression D. HUCUL, D. HAYES, S.M. CLARK, S. DEBNATH, Q. QURAISHI, C. MONROE, University of Maryland Department of Physics — Control of spin dependent forces is important for generating entanglement and realizing quantum simulations in trapped ion systems. Here we propose and implement a composite pulse sequence based on the Molmer-Sorenson gate to decrease gate infidelity due to frequency and timing errors. The composite pulse sequence uses an optical frequency comb to drive Raman transitions simultaneously detuned from trapped ion transverse motional red and blue sideband frequencies. The spin dependent force displaces the ions in phase space, and the resulting spin-dependent geometric phase depends on the detuning. Voltage noise on the rf electrodes changes the detuning between the trapped ions' motional frequency and the laser, decreasing the fidelity of the gate. The composite pulse sequence consists of successive pulse trains from counter- propagating frequency combs with phase control of the microwave beatnote of the lasers to passively suppress detuning errors. We present the theory and experimental data with one and two ions where a gate is performed with a composite pulse sequence. This work supported by the U.S. ARO, IARPA, the DARPA OLE program, the MURI program; the NSF PIF Program; the NSF Physics Frontier Center at JQI; the European Commission AQUTE program; and the IC postdoc program administered by the NGA.

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