Abstract Submitted
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Suppression of off-resonant carrier excitations via a standing wave gate beam[1] THOMAS DELAUBENFELS, School of Physics, Georgia Inst of Tech, KARL BURKHARDT[2], GRAHAME VITTORINI[3], KENNETH BROWN, School of Chemistry and Biochemistry, Georgia Inst of Tech, KENTON BROWN, J. TRUE MERRILL, JASON AMINI, CURTIS VOLIN, ALEXA HARTER, Georgia Tech Research Inst — The motional dynamics of ions in rf traps lead to secular sidebands in their excitation spectra. The relative coupling strengths of the carrier and the sidebands are usually fixed by the Lamb-Dicke factor and ion temperature. We show that the strengths of the carrier resonance and the first order sidebands may be selectively emphasized or suppressed relative to one another. Using $^{40}Ca^{+}$ ions trapped in a surface electrode trap, we excite the $|S_{1/2}> \rightarrow |D_{5/2}>$ electric quadrupole (E2) transition with laser light that is normally incident to the trap's surface. Retroreflection off the trap surface produces a standing wave. For an E2 transition, the carrier couples to the gradient of the electric field and the sidebands to the magnitude. By moving the ion through the standing wave we alternatively suppress and excite the carrier and sideband transitions with the two sets of fringes 180 degrees out of phase. This technique could be used to suppress off-resonant carrier excitations in two qubit gates, and the fringes themselves provide a measure of the ion displacement that can be used to map out the trapping potentials.

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