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Coherent control of population transfer between Wannier-stark states in an optical lattice via one- and two- phonon interference CHAO ZHUANG, CHRISTOPHER PAUL, SAMANSA MANESHI, LUCIANO CRUZ, AEPHRAIM STEINBERG, CQIQC, IOS, and Department of Physics, University of Toronto, Canada — We demonstrate coherent control of population transfer between quantum vibrational states in an optical lattice by using interference between a 2-phonon excitation at ω and a 1-phonon excitation at 2ω. By varying the relative phase between phase modulation (PM) of the lattice at ω and amplitude modulation (AM) at 2ω, we observe oscillations in the branching ratio between transition to the first excited state and higher excited states. We will present experimental data showing the quantum interference between a 2-PM-phonon and a 1-AM-phonon for different excitation amplitudes. Our best result, by tuning the excitation amplitude and relative phase, shows an improvement of coupling into the first excited state by 23% and the branching ratio by a factor of 3.5 ± 0.7, when the total population in the higher excited states is reduced to our measurement noise level.

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