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Robust and Efficient Population Transfer in Ultracold Rubidium Using A Single Linearly Chirped Laser Pulse With a Novel Pulse Envelope[1] THOMAS COLLINS, SVETLANA MALINOVSKAYA, Stevens Institute of Technology — The ability to manipulate the state of a quantum system is the at very heart of the field of quantum control. As quantum control is an essential aspect of the emerging field of quantum computing, it is necessary to find techniques for manipulating quantum systems that are both robust and efficient to implement industrially. In this work the population dynamics of the valence electron of Rubidium, interacting with a single linearly chirped laser pulse, are studied. The pulse envelope is constructed from overlapping Gaussian waveforms and is described analytically by the formula: $E_0 \sum_{\beta=-n}^{n} Exp\{\frac{-[t-(T-n*\epsilon)]^2}{2\tau_0^2}\}$ with the parameter ϵ being the separation in time between each peak with the oscillating electric field is phase locked to the central peak. The response of the quantum yield obtained at the end of the pulse to changes in the parameters of the oscillating electric field and pulse envelope are studied. For certain values of these parameters, achievement of a transfer of over 99% of the population to a desired quantum state within the hyperfine structure of the $5S$ shell via adiabatic passage using beam intensities which are on the order of $100W/cm^2$ is demonstrated. Results are robust in the adiabatic regime.

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