

Abstract Submitted
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Dressed state analysis of population inversion in a 4-level system comprised of hyperfine states in Rb interacting with a single nanosecond, chirped pulse¹ GENGYUAN LIU, SVETLANA MALINOVSKAYA, Stevens Institute of Technology — Ultracold alkali atoms have been conventionally used for quantum operations. In the previous work, a semiclassical model of a single pulse interacting with the hyperfine states of $5S_{1/2}$ and $5P_{1/2,3/2}$ in Rb is presented revealing quantum control parameters that provide population inversion within $5S_{1/2}$. Here, to understand the mechanism of two-photon adiabatic passage induced by a single narrow-band pulse, we analyze the dressed state picture in the four-level system. We also perform a comparative analysis with a three-level Λ system that works as a good approximation within a certain range of parameters. We study the dressed states evolution when the key field parameters, the peak Rabi frequency, the chirp rate and the pulse duration, induce both the adiabatic and nonadiabatic regime of light-matter interaction. The analysis reveals the mediating role of the excited state manifold in adiabatic passage.

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